Michigan's Nonpoint Source Program Plan

Michigan Department of Environment, Great Lakes, and Energy

Water Resources Division

Nonpoint Source Program

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LIST OF ACRONYMS

AOC	Area of Concern
AIS	Aquatic Invasive Species
BANCS	Bank Assessment for Nonpoint source Consequences of Sediment
BEACH Act	Beaches Environmental Assessment and Coastal Health Act
BMP	Best Management Practices
BUI	Beneficial Use Impairment
CAFO	Concentrated Animal Feeding Operation
CNMP	Coastal Nonpoint Management Plan
CMI	Clean Michigan Initiative
CREP	Conservation Reserve Enhancement Program
CSO	Combined Sewer Overflow
CWA	Clean Water Act
EGLE	Michigan Department of Environment, Great Lakes, and Energy
EQIP	Environmental Quality Incentives Program
FEMA	Federal Emergency Management Agency
FY	Fiscal Year
GI	Green Infrastructure
GIS	Geographic Information System
GLRI	Great Lakes Restoration Initiative
GLWQA	Great Lakes Water Quality Agreement
GRTS	Grants Reporting and Tracking System
HUC	Hydrologic Unit Code
I&E	Informational and Educational
LaMP	Lakewide Management Plan
LGROW	Lower Grand River Organization of Watersheds
LHD	Local Health Department
LID	Low impact development
LiDAR	Light Detection and Ranging
LLWFA	Landscape Level Wetland Functional Assessment
MAEAP	Michigan Agriculture Environmental Assurance Program
MDARD	Michigan Department of Agriculture and Rural Development
MDNR	Michigan Department of Natural Resources
MDOT	Michigan Department of Transportation
MiCorps	Michigan Clean Water Corps
MILP	Michigan Inland Lakes Partnership
MiRAM	Michigan Rapid Assessment Method
MNSP	Michigan Natural Shoreline Partnership
MS4	Municipal Separate Storm Sewer Systems
MSU	Michigan State University
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
NREPA	Natural Resources and Environmental Protection Act, 1994 PA 451, as amended
NWCA	National Wetland Condition Assessment
PCB	Polychlorinated biphenyl
QAPP	Quality Assurance Project Plan
RAP	Remedial Action Plan
R-B Index	Richards-Baker Flashiness Index

RCPP	Regional Conservation Partnership Program
RFP	Request for Proposal
RPST	Recovery Potential Screening Tool
SAW	Stormwater, Asset Management, and Wastewater
SBCI	Saginaw Bay Coastal Initiative
SCHD	Shiawassee County Health Department
SEMCOG	Southeast Michigan Council of Governments
SESC	Soil Erosion and Sedimentation Control
SFPF	Stream Functions Pyramid Framework
SIDMA	Social Indicators Data Management and Analysis
SIPES	Social Indicators Planning and Evaluation System
SQT	Stream Quantification Tool
SRF	State Revolving Fund
SSO	Sanitary Sewer Overflow
STORET	Storage and Retrieval System
SUSTAIN	System for Urban Stormwater Treatment and Analysis INtegration
SWAS	Surface Water Assessment Section
SWQIF	Strategic Water Quality Initiatives Fund
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WMP	Watershed Management Plan
WRD	Water Resources Division (formerly known as Water Bureau [WB])
WQS	Water Quality Standards
WQX	Water Quality Exchange

CHAPTER 1: INTRODUCTION

Pollutants that originate from diffuse sources such as fields and parking lots remain among the most significant problems degrading or threatening the water quality of Michigan's lakes, streams, wetlands, and groundwater. These NPS pollutants encompass a diverse range of substances varying from natural compounds, such as sediment, to commercially produced chemical pesticides. The pervasive nature of the problem is widely recognized, although often not well understood, and there are numerous organizations and groups throughout Michigan taking action to address the causes, sources, or impairments.

Eliminating NPS pollution is a critical task for EGLE given that most of the remaining water quality impacts in Michigan are caused, in part, by these sources. The NPS Pollution Control Program (NPS Program) is unique compared to many programs managed by EGLE because of the variety and diversity of public and private entities involved in NPS pollution control, the variety and diversity of NPS pollution, and the lack of EGLE's control over many decisions that impact water quality. Most of the actions taken to control NPS pollution are best coordinated and implemented at the local level. Some actions can only be implemented at the local level, for example, land use planning decisions, or ordinances. The responsibilities of the various local, state, and federal entities for NPS pollution control must be coordinated to make certain that limited resources are used efficiently and effectively to ensure that the shared responsibility for protecting water resources is achieved.

1.1 Background

The federal CWA of 1987 directed the Governor of each state to assess the extent of NPS pollution and prepare a four-year management plan to address NPS pollution.

NPS Assessment

Early in 1988, Michigan conducted a survey of natural resources, environmental, and agricultural agencies in Michigan regarding their perception of the extent of NPS pollution. The results were published as *Michigan's 1988 Nonpoint Pollution Assessment Report*. This report was Michigan's response to the CWA requirement to assess the extent of NPS pollution in the state. Michigan's NPS assessment has been updated every two years since 1988 via Michigan's biennial report to the USEPA regarding water quality and pollution control in Michigan. The CWA requires Michigan to prepare a biennial report on the quality of its water resources as the principal means of conveying water quality protection/monitoring information to the USEPA and the United States Congress. The "Integrated Report" satisfies the listing requirements of Section 303(d) and the reporting requirements of Sections 305(b) and 314 of the CWA. The Section 303(d) list includes Michigan water bodies that are not attaining one or more designated uses and require the establishment of TMDLs to meet and maintain WQS. The 2016 Integrated Report titled, *Water Quality and Pollution Control in Michigan 2016 Sections 303(d), 305(b), and 314 Integrated Report*, was approved by the USEPA.

NPS Pollution Control Management Plan

Also early in 1988, Michigan began work on the four-year management plan required by the CWA. A 23-member NPS Advisory Committee and 9 NPS technical committees comprised of 147 members used the information regarding sources and the extent of NPS pollution provided in the 1988 Assessment Report to develop *Michigan's NPS Pollution Control Management Plan.* The purpose of this management plan was to improve and protect the waters of the state from impacts of NPS pollution and to achieve and maintain WQS, including meeting designated uses.

The NPS Program Plan was updated in 1999 with Michigan's Response to the Nine Key Elements of an Effective Nonpoint Source Management Program. The 1999 update was developed following the USEPA's 1996 release of its Nonpoint Source Program Guidance for FY 1997 and Future Years. The USEPA's guidance document presented a framework for

reviewing, revising, and approving enhanced state NPS management programs, and a new framework for the national NPS grants program. The USEPA guidance presented a list of nine key elements that characterize an effective and dynamic state NPS Program designed to achieve and maintain WQS and designated uses. States were instructed to review and, as appropriate, revise their NPS management plans to reflect each element.

NPS Reengineering Report

In 2005, EGLE initiated an effort to review Michigan's NPS Program. The purpose of the review was to ensure that the program goals and approach were appropriate, and to evaluate how the NPS Program interacts with other programs developed to control diffuse pollution. To accomplish this task, EGLE invited a diverse group of 33 internal and external stakeholders to join the NPS Program Reengineering Committee. The committee was charged to identify core NPS pollution issues and activities that could address those core issues, provide recommended changes and enhancements to EGLE's existing NPS Program, and develop recommendations to realign EGLE's resources to effectively administer the NPS Program in Michigan.

The committee reviewed available NPS Program materials and summaries of water quality monitoring reports, conducted surveys of internal and external programs, conducted a survey of other state programs, and conducted surveys of external stakeholders. In 2006, the committee produced a final report that identified the most serious NPS pollution threats on a statewide and regional basis; identified areas in which the NPS Program could better support and interact with local groups and other external stakeholders; and identified external programs that affect NPS pollution abatement programs and described how those programs interface with the NPS Program. In addition, the report included a series of recommendations intended to help establish program direction and communicate results as well as identify the most important types of activities to address NPS threats to water quality.

EGLE used the re-engineering report and the NPS Program Plan to focus attention on the following areas of action:

- **Education and Outreach:** The Program Plan identifies a number of strategies and short-term actions to advance education and outreach activities including prioritizing watersheds for restoration and protection; identifying specific targets for education and outreach projects; and identifying measures of success.
- **Monitoring:** The Program Plan identifies strategies and short-term actions necessary to identify NPS impairments, measure program effectiveness, and report program success.
- **Technical Assistance:** The Program Plan includes a number of strategies and short-term actions intended to enhance efforts to provide technical assistance such as development of BMP manuals; providing GIS expertise to stakeholders; providing technical assistance to local groups working to develop and implement WMPs; and providing technical assistance to other programs.
- **Partnerships:** The Program Plan includes some strategies and short-term actions intended to improve partnerships with programs internal to EGLE as well as partnerships with external stakeholders.
- **Enforcement:** The Program Plan includes strategies and short-term actions to better integrate enforcement activities.

Finally, the reengineering report noted the need to prioritize water bodies and watersheds for action and the Program Plan includes several long- and short-term goals intended to prioritize

watersheds for plan development and implementation as well as prioritize education and outreach activities.

2007 NPS Program Plan Update

Development of the 2007 Program Plan update was guided by the NPS Program Committee comprised of EGLE NPS staff. The NPS Program Committee divided into technical teams to address specific issues. They reviewed the original 1988 Management Plan, 1999 Nine Key Elements document, and 2006 NPS Reengineering Report as well as NPS Management Plans developed by other USEPA, Region 5, states prior to developing the update.

The 2007 Program Plan update addressed the USEPA's nine key elements of an effective and dynamic state NPS Program. Staff reviewed the commitments included in the 1999 Nine Key Elements Document and retained or updated the best of those commitments. In addition, staff reviewed the recommendations from the 2006 NPS Reengineering Report and translated the relatively general recommendations from that report into the specific long- and short-term commitments incorporated in the 2007 Program Plan update.

2009 NPS Program Plan Update

The 2009 Program Plan update was again guided by the NPS Program Committee comprised of EGLE staff. The revisions were relatively minor compared to the 1999 and 2007 updates. The 2009 updates included a new section with long- and short-term goals related to identifying and addressing water quality impairments caused by on-site septic systems; new short-term goals related to dam removal projects; removal of short-term goals that were completed; and revisions to some short-term goals that are ongoing. The 2009 Program Plan was used to guide NPS Program annual work plans for 2009, 2010, 2011, and 2012.

2012 NPS Program Plan Update

The NPS Program Committee revised the Program Plan in 2012. The 2012 updates included the addition of new program measures of success; revisions to the education and outreach long- and short-term goals; new long- and short-term goals related to green infrastructure (GI); and updates to the list of NPS priority watersheds. In addition, completed short-term goals were removed and "next steps" added. The 2012 Program Plan was used to guide NPS Program annual work plans for 2013, 2014, and 2015.

2015 NPS Program Plan Update

The NPS Program Committee revised the Program Plan again in 2015. The 2015 update reflects the new Federal Register Guidance (*Nonpoint Source Program and Grants Guidelines for States and Territories* including the new *Key Components of an Effective State NPS Management Program*) released on April 12, 2013. In addition, the revisions to the NPS Program Plan include a more detailed description of the NPS Program's watershed prioritization process; a focus on a more comprehensive approach to addressing agricultural NPS pollution; and a section covering NPS pollutants and threats to water quality associated with climate change and AIS. The 2015 Program Plan was used to guide NPS Program annual work plans for 2016 through 2109.

2019 NPS Program Plan Update and Future Updates

The 2019 updates includes revisions to the program measures of success; updates to the prioritization process; updates to the monitoring chapter to document changes to the targeted monitoring prioiritization process; clarification of NPS Program priorities regarding BMPs to deal with pollutants and causes of impairments from several source categories including agriculture,

urban storm water, hydrologic alterations, and on-site septics. In addition, completed short-term goals were removed and “next steps” added.

Existing Staff Resources

The Section 319 grant supports staff in EGLE to implement the NPS Program Plan. These staff members are located centrally in Lansing and in eight district offices across the state. The WRD is responsible for administering most elements of the NPS Program including grant administration, program planning and priority setting, compliance and enforcement, information and education, outreach, monitoring, and technical assistance to stakeholders. Much of the program planning, grant administration, education and outreach, and monitoring is coordinated centrally by staff in Lansing. District office staff duties generally include more decentralized activities such as developing partnerships with local watershed groups or stakeholders, technical advice to local entities, NPS complaint response, problem verification, compliance and enforcement, and helping to identify and develop BMPs to address NPS threats.

The long-term goals, objectives, strategies, and short-term actions included in the NPS Program Plan are intended to direct staff to identify priority watersheds or water bodies; identify problems that need to be fixed or places that should be protected; restore or protect those priority areas using tools that are identified throughout the Program Plan; and measure and communicate those successes.

1.2 NPS Program Vision and Goals

Setting program goals is the first step toward integrating the NPS Program’s Vision into an outcome-based strategic management process. Goals are necessary to provide a clear and unified direction and goals are the standard by which the NPS Program measures its performance.

NPS Program Vision

> The NPS Program will protect high quality waters from NPS threats and restore waters impaired by NPS pollution or causes.

NPS Program Goals

I. Develop and implement WMPs to restore and protect priority watersheds.
II. Eliminate or reduce NPS pollutants and causes of impairments.
III. Increase public awareness of NPS pollutants and causes of impairment and encourage individuals to adopt behaviors to reduce NPS pollutants and causes of impairments.
IV. Efficiently manage pass-through grants and help stakeholders identify funding sources to restore and protect watersheds.
V. Support compliance and enforcement efforts to restore and protect priority watersheds.
VI. Focus monitoring to document impairments and threats to high quality waters, and assess the effectiveness of efforts to restore and protect priority watersheds.
VII. Efficient program operations.

CHAPTER 2: MICHIGAN WATER RESOURCES INVENTORY

2.1 Designated Uses

Designated uses of the waters of the state are described in the Part 4 Rules, WQS, promulgated under Part 31, Water Resources Protection, of the NREPA. At a minimum, all of Michigan's surface waters are designated for, and shall be protected for, all of the following uses: agriculture, navigation, industrial water supply, fish consumption, warmwater fisheries, other aquatic life and wildlife, and partial body contact recreation. Coldwater fisheries and public water supply are protected in certain designated waters, and all surface waters of the state serving as migratory routes for anadromous salmonids shall be protected as necessary to assure that migration is not adversely affected. In addition, all waters of the state are designated for, and shall be protected for, total body contact recreation from May 1 to October 31. Also, the WQS include specific numeric or narrative criteria for microorganisms, plant nutrients, dissolved oxygen, toxic pollutants, and temperature.

Any Michigan water body that is not attaining one or more designated uses or is not meeting WQS is placed on Michigan's nonattainment list and reported to the USEPA as required by Section 303(d) of the federal CWA.

The primary NPS pollutants and causes of impairment addressed by the NPS Program are:

- Nutrients and sediments from diffuse sources or erosion including agricultural runoff, unpermitted storm water runoff, erosion from road stream crossing, and erosion due to hydrologic alteration of streams.
- Bacteria from NPS sources such as on-site septic systems or other unpermitted decentralized wastewater treatment systems, nonpermitted agricultural sources, pet waste, and in some circumstances wildlife (e.g., concentrated waterfowl at beaches).
- Hydrologic alterations or other flow regime alterations caused by impervious surfaces or channel alterations.
- Direct habitat alterations that cause or threaten designated use impairments.
- Loss of riparian buffers that filter pollutants and minimize soil erosion.
- Impairments from legacy mining operations that were never covered by permits.
- Impairments from legacy forestry operations that were never covered by permits.
- Water quality impairments caused by dams.
- Thermal alterations caused by activities such as increases in impervious surfaces or loss of riparian buffers.

2.2 Resource Inventory

Michigan's 2016 Integrated Report includes an inventory of surface water resources including Great Lakes and their connecting channels, inland lakes, rivers, and wetlands (Table 2.1). Michigan's Integrated Report summarizes water quality as follows:

In general, the open waters of the Great Lakes have good to excellent water quality. The inland waters of Michigan's Upper Peninsula and the northern half of the Lower Peninsula support diverse aquatic communities and are commonly found to have good to excellent water quality. Many lakes and rivers in this mostly forested area of the state support coldwater fish populations. Lakes and rivers in the southern half of Michigan's Lower Peninsula generally have good water quality and support warmwater biological communities as well as some

coldwater fish populations. The southern portion of the state contains Michigan's major urban areas with much of the rural land in agricultural production. Many of Michigan's rivers and lakes receive direct discharge of treated effluent from municipal and industrial sources as well as runoff from urbanized areas, construction-sites, and agricultural areas. Sedimentation, nutrient enrichment, and toxic pollutant loading are problems associated with runoff that can impact surface water quality. Surface water quality is generally showing improvement where programs are in place to correct problems and restore water quality.

Table 2.1 Michigan's Water Resources.

Resource	Number	Area	Length	Source
Great Lakes, Great Lakes bays, and Lake St. Clair		42,167 mi^2 (~45% of total Great Lakes area)		USGS National Hydrography Dataset (1:24,000 scale)
Inland lakes and reservoirs with surface area ≥ 0.1 acre	46,000	872,109 acres		USGS National Hydrography Dataset (1:24,000 scale)
Rivers and streams (including connecting channels)			76,439 mi	USGS National Hydrography Dataset (1:24,000 scale)
Wetlands		6,465,109 acres		USFWS National Wetland Inventory

2.2.1 Great Lakes

The Great Lakes contain 20 percent of the world's fresh surface water and are a unique natural resource. Generally, the open waters of the upper Great Lakes (Superior, Michigan, and Huron) have excellent water quality. Exceptions include a few impaired locations restricted to nearshore zones influenced by large, densely populated, and heavily industrialized urban areas. Phosphorus load reductions have contributed to water quality improvements in the Great Lakes and Connecting Channels. These load reductions are the result of numerous efforts to control point and nonpoint sources including efforts to develop and implement WMPs; phosphorus limits on point source discharges; and statewide bans or limits on the use of phosphorus in laundry detergent, dishwashing detergent, and lawn fertilizers.

Detailed designated use support summaries for Michigan waters of the Great Lakes are provided in the 2016 Integrated Report. Key findings for Michigan waters of the Great Lakes, connecting channels, and Lake St. Clair include:

- Deposits of dead and decaying organic matter continue to periodically foul beaches along Michigan's Great Lakes shoreline including, but not limited to, Grand Traverse Bay, Saginaw Bay, and western Lake Erie. Although phosphorus concentrations do not appear to be solely responsible for the shoreline deposits, programs and policies intended to reduce phosphorus in all waters of the state remain important components of efforts to improve and protect water quality.

- In 2013, 239 public beaches on the Great Lakes were monitored and 175 (73 percent) reported no exceedances of the *Escherichia coli* WQS for total body contact. There were 64 beaches that reported a total of 107 exceedances. In 2014, 160 public beaches were monitored and 108 (68 percent) reported no exceedances of the *E. coli* WQS for total body contact. There were 52 beaches that reported a total of 94 exceedances.

2.2.2 Inland Lakes

Michigan has approximately 46,000 inland lakes (including lakes, ponds, and river impoundments) with a surface area of at least one-tenth of an acre or greater. Of these, 730 have public access. Although Michigan's inland lakes generally have good to excellent water quality, some water quality issues occur. The majority of Michigan's public access lakes have moderate or low nutrient levels; however, nutrient levels are high enough in several lakes to warrant corrective action through the implementation of a TMDL.

The majority (72 percent) of Michigan's public access lakes have moderate (mesotrophic) or low (oligotrophic) nutrient levels. The trophic status of Michigan's public access lakes is summarized in Table 2.2.

Table 2.2. Trophic status summary of Michigan's public access lakes.

Trophic Status	Number of Lakes
Oligotrophic (low nutrients)	129 (18 percent)
Mesotrophic (moderate nutrients)	399 (54 percent)
Eutrophic (high nutrients)	174 (24 percent)
Hypereutrophic (excessive nutrients)	28 (4 percent)
Total Assessed	730

Many lakes with moderate to high nutrient levels are located in the southern Lower Peninsula where large population centers and fertile soils exist. Many lakes with low nutrient levels are located in the northern Lower Peninsula where the population density is lower, soils are less fertile, and lakes tend to be larger and deeper.

In 2013, a total of 174 public beaches (owned by a city, county, etc.) on inland lakes were monitored and 140 (80 percent) had no exceedances of the *E. coli* WQS for total body contact. There were 34 beaches that reported a total of 55 exceedances. In 2014, a total of 174 public beaches on inland lakes were monitored and 150 (86 percent) had no exceedances of the *E. coli* WQS for total body contact. There were 24 beaches that reported a total of 35 exceedances.

According to the 2016 Integrated Report, approximately 6,700 acres of inland lakes and reservoirs are not supporting designated uses due to excessive nutrients; 4,300 acres are not supporting designated uses due to excess algal growth; and 2,200 acres are not supporting designated uses due to pathogens. Detailed designated use support summaries for Michigan's Inland lakes are available in the 2016 Integrated Report.

In 2007, EGLE assisted the USEPA with the National Lakes Assessment survey. EGLE led efforts to monitor 50 of Michigan's inland lakes with a surface area greater than 10 acres. These lakes were selected randomly and assessments included chemical, biological, and physical indicators. The survey indicated that 86 percent of Michigan's lakes supported healthy communities while only 3 percent were in poor biological condition. Approximately 84 percent of

Michigan's lakes were low (oligotrophic) to moderately (mesotrophic) productive and less than 4 percent exhibited excessive biological productivity (hypereutrophic). However, physical impacts to lakeshore and littoral habitats were found to be the greatest stressors for lakes in Michigan with nearly 40 percent of Michigan's lakes in poor condition.

The National Lakes Assessment survey was repeated in 2012 and the results were similar. Only 9 percent of Michigan's lakes were categorized as "most disturbed" due to nutrient enrichment. However, the survey found that the greatest stressor for Michigan's inland lakes larger than 10 acres was physical impacts to lakeshore and littoral habitats with nearly 50 percent of Michigan lakes estimated to be in the most disturbed condition. The National Lakes Assessment was repeated again in 2017 but the USEPA's final report is not yet available.

2.2.3 Rivers and Streams

Michigan has an estimated 76,421 total river miles identified in the USGS National Hydrography Database. Michigan's rivers can be grouped by the distinct ecoregions through which they flow. Each of the five ecoregions in Michigan consists of areas that exhibit relatively similar geological landform characteristics (Figure 2.1). Factors used to delineate ecoregions include climate, soils, vegetation, land slope, and land use. This framework provides information on the environmental characteristics that tend to occur within each ecoregion. In order by size (largest to smallest area), the five ecoregions in Michigan are Southern Michigan/Northern Indiana Till Plains, Northern Lakes and Forests, North Central Hardwood Forests, Huron-Erie Lake Plains, and Eastern Corn Belt Plains.

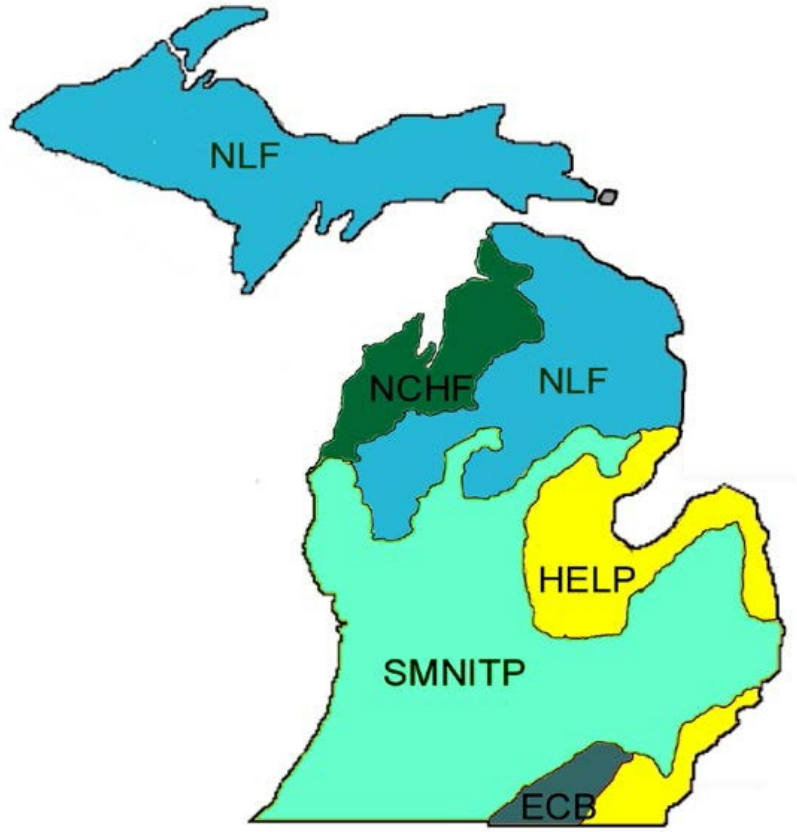
Rivers in the Northern Lakes and Forests and North Central Hardwood Forest ecoregions tend to support coldwater fish within at least a portion of their systems. These rivers commonly have relatively small watersheds, high relief topography, substantial groundwater inputs, and are naturally low in productivity. Most rivers in the Northern Lakes and Forests ecoregion are perennial, often originating from lakes or wetlands. Although relatively free of sediment, surface waters in this ecoregion often have a characteristic brownish color because of elevated concentrations of dissolved organic material, including tannins and lignins. In the North Central Hardwood Forests ecoregion, river flow is highly variable, being entirely intermittent in some portions of the ecoregion and entirely perennial in others. These rivers typically drain soils with much poorer nutrient content than in bordering ecoregions to the south.

Rivers in the Southern Michigan/Northern Indiana Till Plains ecoregion are generally of good quality in the headwaters. This ecoregion is drained predominantly by perennial rivers. Such rivers are typically sluggish and are bordered, often extensively, by wetland tracts. Drainage ditches and channelized rivers have been a common solution to assist drainage of areas that are too wet for development or agriculture.

Upland features related to poor soil drainage heavily influence the rivers in the Huron-Erie Lake Plains and Eastern Corn Belt Plains ecoregions. Broad and nearly level lake plain is crossed by beach ridges and low moraines, which has resulted in the formation of poorly drained soils. More than half of the rivers in the Huron-Erie Lake Plains ecoregion are intermittent, and river flows are commonly runoff-dependent. In addition to the construction of numerous drainage ditches, the headwaters of many rivers are extensively channelized for quicker drainage and to improve upland field conditions. About half of the rivers in the Eastern Corn Belt Plains ecoregion are perennial and many have been channelized to assist soil drainage. This ecoregion is almost entirely farmland, and river quality is influenced by increased soil and water runoff from agricultural land uses.

Detailed designated use support summaries for Michigan's rivers and streams are available in the 2016 Integrated Report. Key findings for rivers and streams include:

Figure 2.1. Ecoregions of Michigan (adapted from Omernick and Gallant, 1988).[1]



SMNITP - Southern Michigan/Northern Indiana Till Plains
NCHF - North Central Hardwood Forests
NLF - Northern Lakes and Forests
HELP - Huron-Erie Lake Plains
ECB - Eastern Corn Belt Plains

- Approximately 20 percent of the river miles assessed do not support the other indigenous aquatic life and wildlife designated use. Habitat alterations are a common cause of this designated use impairment.
- The majority of the river miles that are not supporting one or more designated uses indicated by poor biological communities have been highly modified by channel maintenance activities carried out primarily by Michigan's county drain commissions. These channel maintenance activities (including channel straightening, dredging, riparian vegetation removal, and snag removal) may result in poor biological communities caused by non-pollutants (habitat and/or flow alterations).
- Of the approximately 9,242 river miles assessed for the total body contact recreation designated use, about 2 percent were determined to support this designated use.

[1] Omernik, J. and A. Gallant. 1988. Ecoregions of the Upper Midwest States. USEPA, Envir. Res. Lab. Publication #EPA/600/3-88/037.

However, these river miles were targeted for monitoring based on suspected *E. coli* sources.

- Over 7,200 river and stream miles are not supporting designated uses due to flow alteration, sedimentation/siltation, oxygen depletion, nutrients, and excess algal growth.

2.2.4 Wetlands

Michigan's aquatic resources include approximately 6,465,000 acres of wetlands, some of exceptional quality and rarity. EGLE administers a statewide wetland regulatory program. It also manages Michigan's wetland resources through public education, with programs to encourage wetland preservation and restoration, by cooperating with governmental and nongovernmental agencies to encourage the evaluation and management of wetlands on a local and watershed basis, and through a developing monitoring and assessment program.

Estimates of wetland losses since European settlement range from 35 percent, based on the Michigan Natural Features Inventory pre-settlement inventory, to 50 percent, based on the USFWS National Wetlands Inventory. Sources of wetland loss include permitted activities; unpermitted activities (i.e., violations of state and federal law); agricultural and silvicultural practices, which are exempt under state and federal law; the loss of small, isolated wetlands that are not under state or federal jurisdiction; natural processes (e.g., beaver activity); and indirect effects (e.g., alteration of drainage networks due to urbanization). Wetland acreage may increase for some of the same reasons (e.g., changes in drainage pathways). However, most wetland gains are attributed to voluntary wetland restoration projects, pond construction, and mitigation for permitted impacts.

Michigan's WQS apply to all surface waters of the state, including wetlands. However, some criteria may not be applicable to wetlands. For example, a highly productive wetland with abundant vegetation in shallow water and high organic content in the sediment may naturally exhibit low dissolved oxygen levels in the water column. Based on Rule 100(10) (R 323.1100[10]) of the Part 4 Rules, WQS, promulgated under Part 31, Water Resources Protection, of the NREPA, use attainability studies are allowed for certain wetlands to address this situation.

Michigan's wetlands are currently assessed for designated use support on an as-needed basis. Designated use support summaries are available in the 2016 Integrated Report.

2.2.5 Groundwater

While Michigan has abundant, high quality surface water resources, slightly less than half of all residents rely on groundwater for their drinking water supply. Approximately 2.6 million Michigan residents are served by privately-owned wells and 1.7 million residents are served by public water systems that rely on groundwater. In addition, a wide range of commercial interests including agriculture, manufacturing, mining and tourism require high quality groundwater. Michigan Industries withdraw 109 million gallons of groundwater daily from on-site wells and over 244 million gallons of groundwater are withdrawn daily in Michigan for irrigation.

CHAPTER 3: WATERSHED MANAGEMENT

GOAL I: Develop and Implement WMPs to Restore and Protect Priority Watersheds

NPS pollution threats and impacts on water quality are diverse, widespread, and often interconnected. Each water body has distinct water quality characteristics, issues, and stakeholders. A watershed approach, which provides a flexible framework for managing water quality within hydrologically defined areas, is viewed as the most effective means to address water quality concerns on a comprehensive basis. This approach requires active stakeholder involvement, sound scientific analysis and quantification of causes and sources of water quality problems, identification of measurable water quality goals, and specific actions needed to reach the watershed goals. Typically, a planning process takes place first, which identifies an overall management strategy with implementation options that will achieve the water quality goals. The process is meant to be iterative, holistic, hydrologically defined, integrated, and collaborative.

Michigan's NPS Program approves plans that focus on measurable improvements in water quality leading to restoration of impaired waters and protection of high quality waters. Additionally, Michigan's approach encourages identification of local desired uses (e.g., public access, hiking trials, wildlife corridors), in addition to threats and impairments to state designated uses. Michigan's NPS Program has historically followed a policy of getting as many local organizations involved in addressing water quality issues in as many watersheds as possible, thereby leveraging scarce dollars, resources, and local interest to obtain as much water quality improvement or protection activity as possible throughout Michigan. Before state or federal NPS grant funds will be given to implement practices in a watershed, the project must be supported by an approved plan developed via a watershed approach.

The local community approach to addressing water quality is often initially prompted by a single watershed-specific issue such as flooding, bank erosion, increasing development pressure, recreation, aesthetics, or protection of high quality waters. The specific BMPs proposed to address the identified problem often end up being those for which grant funding is available. As a result, more effective BMPs, or higher priority activities, may be overlooked or not considered. In these cases, EGLE generally seeks to encourage local efforts to address the problem identified, but will work with the community to expand their interest and effort into a comprehensive and coordinated watershed level planning project that identifies and prioritizes all water quality issues within the larger watershed.

Objective I-1: Prioritize watersheds for development and implementation of WMPs and implementation of NPS pollutant control activities

The NPS Program recognizes the benefits of distributing resources broadly in an effort to build local capacity and encourage "local ownership" of efforts to restore and protect watersheds. In many cases, small investments can serve as seed money or catalysts for larger efforts with multiple benefits. The NPS Program also acknowledges the benefits of targeting resources to simultaneously correct multiple threats in a single watershed. The NPS Program believes this approach provides the best opportunity to obtain measurable on-site improvements in water quality.

There are a variety of issues that need to be considered when deciding which approach, or combination of approaches, provides the best potential for protecting or restoring water quality throughout the state, including the following:

- Limited state and federal resources available to assist in the implementation of WMPs.
- Varying levels of local interest and participation.

- A wide spectrum of existing water quality conditions ranging from nearly pristine water bodies to those that are severely degraded.
- Differences in the complexity and magnitude of water quality issues.
- Specific local, state, and federal goals for many watersheds.

As a result, priorities are needed to not only guide where protection and restoration resources will be directed in the future, but to help decide how those resources will be provided. Again, it is important to note that watershed prioritization will not necessarily preclude conducting work in non-priority watersheds, but it will help focus overall efforts of the NPS Program.

The NPS Program gives primacy to an area by designating it as a priority watershed. The NPS program focuses resources on priority watersheds. A priority watershed's increased focus may come in the form of grants, technical assistance, monitoring, education and outreach, or enforcement activities. Priority watersheds are reviewed with each update to the NPS Program Plan.

The NPS Program developed a prioritization process to assist with the selection of priority watersheds. The prioritization process allows for watersheds to be ranked based on (1) the potential to restore impaired water bodies; and (2) attributes worthy of protection in high quality watersheds. A secondary goal of this process is to maintain datasets to share with stakeholders for inclusion in the development of WMPs. Based on a review of several prioritization processes, the NPS Program selected the USEPA's RPST to prioritize Michigan's watersheds. The RPST is meant to provide objective criteria for staff to evaluate when determining priority watersheds and targeted water bodies and it serves to enhance, not supplant, best professional judgment.

The current prioritization process uses the ten-digit HUCs as the unit of analysis. Staff evaluated and compiled 115 metrics that fall into the following 3 general categories: ecological indicators, stressor indicators, and social context indicators. The following subset of metrics was selected to populate the RPST in prioritizing Michigan's watersheds:

Ecological Indicators:

- Percent of watershed forested
- Percent of watershed wetland
- Percent of historic wetland remaining
- Percent of 150-meter river buffer in natural landforms
- Percent of 150-meter lake buffer in natural landforms
- Percent of 100-meter wetland in natural landforms

Stressor Indicators:

- Percent of watershed in agricultural landforms
- Percent of watershed in urban landforms
- Percent of watershed tiled
- Watershed road density
- Change in the number of housing units from 1990 to 2000
- Number of septic systems within the watershed

- Percent of river miles with a non-attainment listing
- Percent of 150-meter river buffer in anthropogenic landforms

Social Context indicators:

- Jurisdictional complexity of the watershed
- Percent of watershed in protected lands
- Percent of river miles within the Natural or Scenic Rivers Programs
- Percent of river miles covered by a TMDL
- Number of jurisdictions with a point-of-sale on-site septic ordinance

The RPST normalizes the value of each metric, with the highest value adjusted to 1 or 100 and the remaining values adjusted proportionally. Summary scores are calculated for each general category, as well as a combined score of the three. Resulting combined summary scores are visualized as bubble plots with the x-axis representing the stressor summary score, the y-axis representing the ecological summary score, and the bubble size representing the social summary score (Figure 3.1). Median scores of the ecological and stressor summary scores are established on the plot, dividing it into four quadrants. The highest quality watersheds have low stressor summary scores and high ecological summary scores and reside in the upper left quadrant of the plot. Impaired watersheds in the upper left and right quadrants have the highest potential for restoration. Unimpaired watersheds in the upper left quadrant are the highest priority for protection efforts.

Strategy

I-1-A: Refine the watershed prioritization process and periodically update the lists of priority watersheds.

Short-term Actions

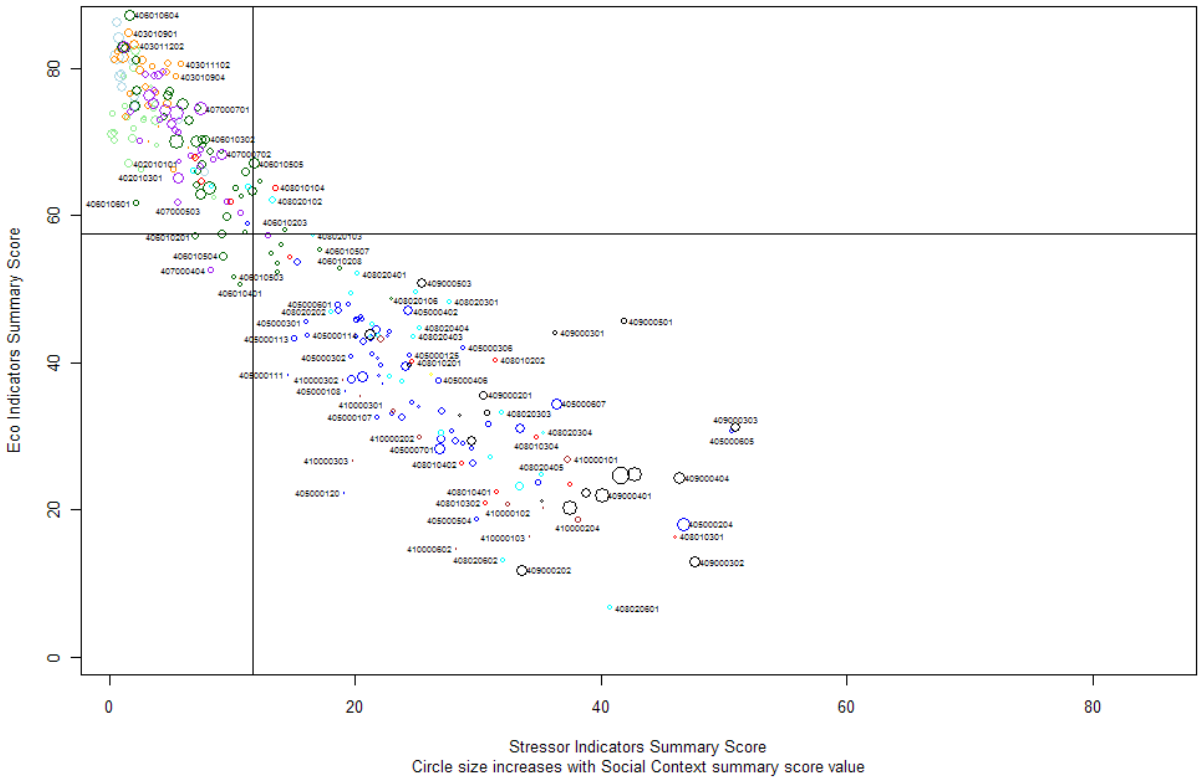
I-1-A-1: By October 31, 2019, NPS Program staff will evaluate additional factors to determine if usable and scalable metrics can be developed.

I-1-A-2: By January 31, 2020, NPS Program staff will evaluate and determine ecological, stressor, and social metrics to be used in the next update to the prioritization process.

I-1-A-3: By April 30, 2020, NPS Program staff will update the RPST and develop metadata documenting the NPS Program's prioritization process.

I-1-A-4: By June 30, 2020, NPS Program staff will evaluate the benefits of prioritizing 12-digit HUCs within the priority ten-digit HUCs.

Figure 3.1. Summary scores for Michigan's watersheds color coded by sub-basin.



Objective I-2: Provide information, guidance and technical assistance to stakeholders working to develop and implement WMPs.

Stakeholders surveyed as part of the NPS re-engineering process identified technical assistance as a high priority activity of Michigan's NPS Program. Stakeholders are especially interested in technical assistance related to development of WMPs and implementation of priority activities to restore and protect water quality.

Strategy

I-2-A: Develop technical updates leading to a new guidance document on watershed management plan development.

The new watershed management planning guidance document will better incorporate the following:

- The USEPA's nine minimum elements, including the new nine element's sub-criteria developed as part of the Tetra Tech, Inc. watershed planning Section 319 project.
- Appropriate size and expected level of detail in WMPs.
- Hydrology and geomorphology.
- Use of GIS and LiDAR datasets.
- Field inventories to identify and quantify sources of NPS pollutants.
- Impaired waters and TMDL load allocations.

- Time period for which the plan is valid (many plans are written to cover a ten-year period) given that EGLE plan approvals are not for an indefinite period.
- Leveraging technical and financial resources to develop WMPs.

Short-term Actions

I-2-A-1: By December 31, 2019, NPS Program staff will have a final draft of a white paper on watershed characterization within a watershed management plan.

I-2-A-2: By July 31, 2020, NPS Program staff will modify the technical revision white paper to a Water Resource Division procedure.

I-2-A-3: By December 31, 2021, NPS Program staff will develop a Water Resource Division procedure outlining the process for revising and updating WMPs.

Strategy

I-2-B: Look for opportunities to build and sustain watershed management capacity at the local level. Capacity in this sense includes the number of people and organizations involved in addressing NPS issues in a watershed; the available funding and technical support; public expectations and political will; and commitment to continual improvement and protection of water quality.

Short-term Actions

I-2-B-1: NPS Program staff will assist with TMDL development for NPS impacted watersheds according to the WRD TMDL prioritization plan and associated schedules. Assistance will include helping identify NPS pollutant sources to be addressed to meet TMDL load allocations.

I-2-B-2: NPS Program District staff will develop and maintain a network of watershed partners to enhance watershed management capacity at the local level.

- Work with watershed groups to develop sustainable funding strategies and mechanisms for watershed management.
- Encourage watershed groups developing or conducting volunteer water quality monitoring to seek coordination and assistance through the Michigan Clean Water Corps (MiCorps) Volunteer Monitoring Program.
- Where no watershed planning effort exists and the NPS Program has identified a need, bring together key partners and facilitate a discussion to promote a watershed planning effort.
- Assist local watershed planning leaders with assembling diverse and representative steering committees.
- Participate on watershed project steering committees and continue to serve on the committees following completion of NPS-funded grant projects.
- Provide networking assistance related to NPS pollution control and establishing working partnerships.
- Encourage interstate partnerships and participation on bi-state watershed projects where appropriate.

Strategy

I-2-C: Continue to improve its statewide use of geospatial analytic tools and data sets to characterize and prioritize watersheds. These data will be used to assist the NPS Program and its stakeholders in identifying potential sources of NPS Pollutants.

Short-term Action

I-2-C-1: Continue to have a core group of NPS staff to:

a. Serve as a point of contact with other agencies, departments, divisions, and WRD programs regarding GIS.

b. Review and evaluate NPS projects use of GIS and geospatial data, recommending modification as appropriate.

c. Provide spatial and temporal tracking of NPS projects.

d. Provide technical assistance to program staff, grantees, stakeholders, and consultants on acceptable geospatial datasets, tools, and evaluation techniques.

e. Promote the acquisition of key geospatial data sets.

Strategy

I-2-D: NPS Program staff will identify, develop, pilot, and evaluate field inventory approaches for agricultural lands for use in the development of WMPs.

Short Term Actions

I-2-D-1: By March 31, 2020, NPS Program staff will complete a protocol for conducting agricultural inventories, including tillage, residue, and animal feeding operation surveys and post the protocol on the NPS Website.

I-2-D-2: By November 30, 2020, develop digital data collection process for tillage and residue inventory and post the protocol on the NPS Website.

I-2-D-3: Continue to encourage and train stakeholders to use LiDAR data and the Agricultural Conservation Planning Framework when developing watershed management plans in areas with agricultural land use.

Strategy

I-2-E: Identify, develop, pilot, and evaluate field inventory approaches for urban lands for use in the development of WMPs.

Short Term Actions

I-2-E-1: By June 30, 2020, NPS Program staff will finalize a protocol for conducting parking lot inventories in urban watersheds and post the protocol on the NPS Website.

I-2-E-2: By December 31, 2022, NPS Program staff will evaluate the use of LiDAR data to quantify percent of tree canopy and riparian buffers within urban watersheds.

Objective I-3: Review and approve WMPs

EGLE formally approves NPS WMPs that: (1) demonstrate sound scientific evaluation of the sources, causes, and mitigation of pollutants impairing or threatening a water body's designated uses; (2) provide a prioritized action plan with timelines and provisions for documenting water quality improvement and protection; (3) are considered current only for the effective life of the plan, which generally corresponds to the task implementation timeline; and (4) meet the

USEPA's nine elements and Michigan's CMI criteria. EGLE approval allows activities identified in WMPs to be eligible for funding consideration under the state CMI bond program, the federal Section 319 program, or both.

In 2007, the NPS Program provided guidance and training to EGLE staff who review NPS WMPs under the CMI or Section 319 programs. The guidance materials and training were provided by Tetra Tech, Inc. Since that time, NPS Program staff has used these materials to review and approve WMPs. However, the NPS Program continues to provide additional guidance and training as new issues and tools arise.

Strategy

I-3-A: All NPS WMPs submitted for EGLE approval from throughout the state will be evaluated consistently with respect to the criteria established for the relevant program(s) for which approval is sought, while accounting for differences in watershed size, land use, and the complexity of relevant water quality issues.

Short-term Actions

I-3-A-1: NPS Program staff will review draft WMPs against CMI and Section 319 criteria within 90 days of receipt of the draft. Detailed comments will be provided when plans are determined to be deficient. Approval letters will be signed by District Supervisors or the NPS Unit Chief when plans are determined to meet appropriate criteria.

I-3-A-2: NPS Program staff will continue to provide guidance and training to all EGLE staff who review NPS WMPs for approval under the CMI or Section 319 criteria.

Objective I-4: Coordinate TMDL development and implementation with NPS WMP development and implementation.

TMDLs are required by the federal CWA for most water bodies that do not meet WQS due to a pollutant. A TMDL is developed by calculating the maximum daily load of a pollutant that a water body can assimilate and meet WQS. This load is then allocated to point sources, NPS, and a margin of safety reserve (to account for technical uncertainties).

TMDLs are typically developed by EGLE and approved by the USEPA. Public involvement is a key aspect of the development process and is particularly important during discussion of allocation and implementation issues. Experience has demonstrated that participation by local communities and landowners leads to more representative TMDLs that can be more readily implemented.

TMDLs are typically implemented through existing programs, such NPDES permits for point source discharges and voluntary, incentive-based NPS control programs, to achieve the necessary pollutant reductions. EGLE and the USEPA have an interest in better integrating NPS pollutant control activities with TMDL development and implementation activities.

Strategy

I-4-A: Better coordinate TMDL development and implementation with NPS Program implementation.

Short-term Actions

I-4-A-1: The NPS Program will continue to place a priority on pass-through grant projects that address TMDL load reductions targets in water bodies that are not attaining designated uses due, at least in part, to NPS causes.

I-4-A-2: NPS pass-through grant projects that propose water quality monitoring to determine the status of designated uses will be required to meet or exceed the State's sampling protocols for 303(d) listing/delisting so the state can make a decision on use support using project data. This requirement does not apply to other water quality monitoring that might be proposed as part of the project, such as pollutant source identification monitoring and some types of project effectiveness monitoring.

I-4-A-3: NPS Program District staff will coordinate with enforcement staff on source identification and remediation in NPS related TMDL watersheds.

Objective I-5: Establish criteria, develop guidance, pilot and evaluate alternative WMPs.

The NPS Program will develop three types of alternative management plans. One category will address a limited range of issues and solutions associated with inland lakes. Development of alternative inland lake management plans will be restricted to natural lakes (no impoundments) with no impairments. A second category will address emergency situations that have the potential to impact water quantity or quality. This would include, but not limited to, dam failures, floods, and wildfires. The final category of alternative plans focusses on watersheds that have a single pollutant and source impacting water quality.

Strategy

I-5-A: Develop criteria, guidance, and a template for inland lake alternative plans.

Short Term Actions

I-5-A-1: By January 31, 2020, NPS Program staff will identify criteria for developing alternative lake management plans.

I-5-A-2: By April 30, 2020, NPS Program staff will prepare guidance and a template for developing alternative lake management plan.

I-5-A-3: By July 31, 2020, NPS Program staff will identify a location to pilot an alternative lake management plan.

I-5-A-4: By April 30, 2021, NPS Program staff will implement and evaluate an alternative lake management plan.

I-5-A-5: By April 30, 2023, NPS Program staff will revise and finalize alternative lake management process.

Strategy

I-5-B: Develop criteria, guidance, and a template for emergency alternative plans.

Short Term Action

I-5-B-1: NPS Program staff will look for opportunities to develop an alternative emergency management plan that addresses water quantity or quality issues.

Strategy

I-5-C : Develop criteria, guidance, and a template for single issue alternative plans.

Short Term Action

I-5-C-1*:* NPS Program staff will look for opportunities to develop an alternative watershed management plan to address single issue projects. The NPS Program will focus primarily on single issues that will result in measurable improvement in water quality.

Objective I-6: Protect high quality waters from NPS impairments.

Michigan is blessed with an abundance of high quality waters as evidenced by the number of water bodies meeting all designated uses as described in the 2016 Integrated Report (when impairments due to atmospheric sources of PCB and mercury are excluded). Michigan's NPS Program has long recognized the benefits of long-term protection of high quality watersheds especially since the cost of restoration is often much higher than the cost of protection. The NPS Program places a priority on long-term protection projects funded through the pass-through grant process, prioritizes water bodies for protection, and tracks measures of success related to long-term protection of high quality waters (see Chapter 9).

In addition, the NPS Program's definition of protection projects includes projects that result in measureable improvement in water quality at high quality sites or reaches without designated use impairments due to NPS pollutants or causes.

Strategy

I-6-A: Continue to place a priority on the protection of high quality waters and watersheds.

Short-term Actions

I-6-A-1: The NPS Program will support pass-through grant projects to limit the contribution of pollutants to high quality waters due to land development. Also, the NPS Program will estimate and report (via the GRTS) sediment and nutrient load reductions that are prevented from entering high quality waters due to long-term protective measures such as conservation easements, ordinances or other protective actions that limit development of riparian land.

1-6-A-2: The NPS Program will support pass-through grant projects to measurably improve water quality at high quality sites or reaches without designated use impairments due to NPS pollutants or causes.

I-6-A-3: The NPS Program will place a priority on grant funded projects to restore and protect priority wetlands. LLWFA will be used to prioritize grant funding for wetland restoration and protection protects. In addition, the NPS Program will maximize opportunities to use Farm Bill Programs and Section 319 WMPs to restore and protect wetlands.

I-6-A-4: NPS Program staff will look for opportunities to work with USEPA staff on their "Healthy Waters Initiative." Specifically, the Program will look for opportunities to develop NPS Program goals and measures of effectiveness associated with protecting the ecological health of high quality waters and watersheds.

Objective I-7: Protect Great Lake coastal areas from NPS pollution and causes of impairment.

The NPS Program has been working with Michigan's Coastal Zone Management Program, NOAA, and the USEPA to develop a CNMP to meet the requirements of Section 6217 of the Coastal Zone Reauthorization Amendments of 1990 and effectively address NPS pollution and causes of impairment within Michigan's Coastal NPS Boundary (Figure 3-2). Michigan's original CNMP was reviewed by the USEPA and NOAA and approved with conditions. Responses for the three remaining unapproved management measures were submitted to the federal partners on March 1, 2019.

Strategy

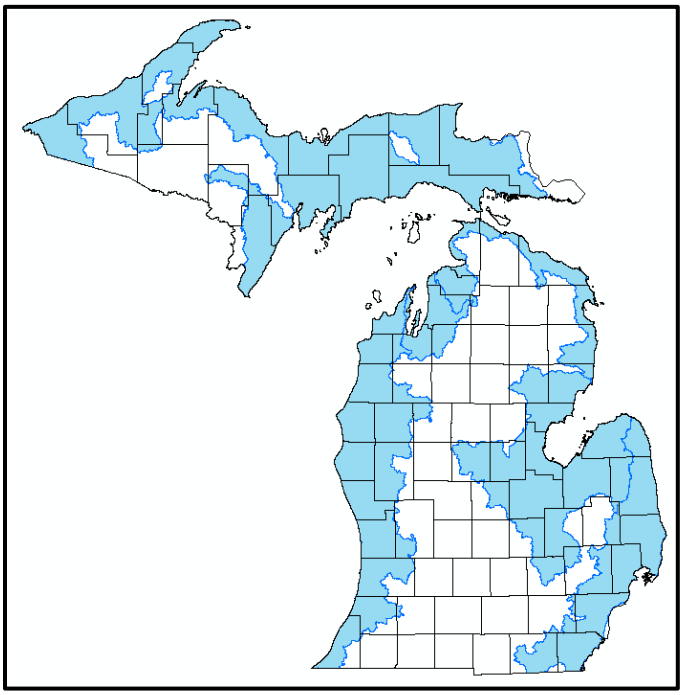
I-7-A: Continue to work with Michigan's Coastal Zone Management Program, NOAA and the USEPA to develop and implement an approvable CNMP.

Short-term Actions

I-7-A 1: The NPS Program will lead efforts to address federal comments on the March 2019 submissions and will assist the Coastal Zone Management Program in the process of obtaining full approval of the CNMP from NOAA and USEPA by June 30, 2021.

I-7-A-2: The NPS Program will continue to implement the CNMP through technical and financial support of projects that are consistent with the CNMP and within the Coastal Nonpoint Source Boundary.

Figure 3.2: Michigan's Approved Coastal NPS Boundary.



Objective I-8: Protect groundwater from NPS pollution and causes of impairment.

Michigan's groundwater is used by almost half of the population for drinking water and provides base flow for many of Michigan's rivers. Protecting this resource from NPS pollution is a priority for the Program. The connections between groundwater and surface water can be complex and the potential impacts to groundwater must be considered prior to implementation of many BMPs intended to restore or protect surface water.

In addition, the effectiveness of BMPs implemented to restore or protect surface water can often be measured relatively quickly compared to BMPs intended to improve groundwater. This lag time must be considered prior to assessing BMP effectiveness.

Michigan's NPS Program will not fund groundwater restoration or protection efforts that are being addressed through other groundwater protection programs. In addition, the NPS Program will not fund infiltration practices that exacerbate groundwater contamination from contaminated sites listed under Part 201, Environmental Remediation; or Part 213, Leaking Underground Storage Tanks, of the NREPA. NPS Unit Staff will provide technical assistance in regard to proper design and location of infiltration practices on brownfield sites which may require a higher degree of engineering to eliminate any exacerbation of on-site conditions.

Strategy

I-8-A: Provide technical assistance to NPS Program staff, communities, universities, and watershed groups regarding groundwater issues.

Short-term Actions

I-8-A-1: NPS Program staff will assist with the development and review of groundwater related portions of WMPs developed by stakeholders.

I-8-A-2: NPS Program staff will provide assistance to stakeholders working to develop or implement BMPs that include infiltration practices or may otherwise impact groundwater resources.

I-8-A-3: NPS Program staff will review all 319 and CMI proposals that include infiltration practices and identify those practices that have the potential to negatively impact groundwater resources.

I-8-A-4: By October 31, 2020, NPS Program Staff will review existing groundwater related BMPs included in the EGLE BMP Manual in context with other reference manuals used by the NPS Program; recommend changes as appropriate for BMPs identified as out of date and identify groundwater related BMPs that should be added to the Manual.

I-8-A-5: NPS Program Staff will look for opportunities to monitor shallow groundwater around detention/retention basins, infiltration practices, wetlands, and groundwater/surface water interface within priority watersheds to assess the impacts of deicers on groundwater and surface water.

Objective I-9: Protect inland lakes and reservoirs from NPS pollutants and causes of impairment.

Michigan has approximately 46,000 inland lakes and reservoirs with a surface area greater than 0.1 acre (approximately 870,000 inland lake acres total). According to the 2016 Integrated Report, less than 1 percent (6,700 acres) of inland lake and reservoir acres have designated use impairments due to nutrients; less than 1 percent (4,300 acres) have designated use impairments due to excessive algal growth; and less than 1 percent (2,200 acres) have designated use impairments due to pathogens. The 2012 National Lake Assessment Survey found that the greatest stressor for lakes larger than 10 acres was physical impacts to lakeshore and littoral habitats with nearly 50 percent of Michigan lakes rated as “most disturbed.” The 2012 survey results highlight the need for programs that encourage riparian and shoreline protection and restoration to improve and maintain inland lake water quality.

Preserving Michigan’s lakes from NPS pollution requires a balance between protection and restoration, using a variety of management strategies, within a structure that recognizes regional differences in lake ecology and land use. Restoring lakes with degraded water quality or habitat has been the major focus of management efforts in the past. However, there is a growing recognition that protecting unimpaired lakes from future degradation is as high a priority as restoring impaired lakes. Management strategies include regulations, incentives, BMP installation where appropriate, education, and planning. These strategies are appropriate throughout a lake’s watershed as well as along the shoreline.

Michigan’s inland lakes are typically supported by motivated stakeholder groups interested in restoration and preservation activities such as developing management plans; participating in Michigan’s Cooperative Lakes Monitoring Program; or participating in programs such as the MNSP and MILP. The NPS Program will continue to support the efforts of lake associations

and other stakeholder groups to restore and protect inland lake water quality from NPS pollutants and causes of impairment.

Strategy

I-9-A: Provide guidance to inland lake stakeholders regarding the use of alternative WMPs for inland lakes.

Short-term Actions

I-9-A-1: By March 31, 2024, NPS Program staff will develop a presentation for staff to use when talking with inland lake groups.

I-9-A-2: By October 30, 2024, provide training for NPS Program staff on the alternative lake planning process.

Strategy

I-9-B: Expand information and education outreach efforts related to BMPs, ordinances, and strategies for inland lake protection.

Short-term Actions

I-9-B-1: NPS Program staff will work with inland lake partners to develop and promote educational, planning and management tools to assist local communities and citizens to protect their lakes.

I-9-B-2: NPS Program staff will continue to provide leadership for inland lake partners to provide educational resources and training for protecting and restoring inland lake shorelines.

I-9-B-3: By March 31, 2021, NPS Program staff will work with inland lake partners to integrate our alternative lake planning process into the Michigan Inland Lakes Partnership Lake Protection Strategy.

I-9-B-4: NPS Program staff will look for opportunities to promote the Midwest Glacial Lakes Lake Viewer. Program staff will show stakeholders how to use the Lake Viewer to help guide lake management decisions.

I-9-B-5: By March 30, 2021, NPS Program staff will develop a “lessons learned” evaluation of the Shoreland Stewards/Shoreline Partnership Programs.

CHAPTER 4: SOURCE CONTROL STRATEGIES

Goal II: Eliminate or reduce priority NPS pollutants and causes of impairment.

The primary NPS pollutants, causes of impairment and threats to high quality waters addressed by Michigan's NPS program are:

- Nutrients and sediments from diffuse sources or erosion including agricultural runoff, unpermitted storm water run-off, erosion from road stream crossing and erosion due to hydrologic alteration of streams.
- Bacteria from NPS sources such as on-site septic systems or other unpermitted decentralized wastewater treatment systems, nonpermitted agricultural sources, pet waste and in some circumstances wildlife (e.g., concentrated waterfowl at beaches).
- Hydrologic alterations or other flow regime alterations caused by impervious surfaces, channel alterations, or improperly designed road stream crossings.
- Direct habitat alterations that cause designated use impairments.

In addition, NPS threats and causes of impairments that are relatively minor on a statewide basis may be locally important within individual watersheds and best addressed through implementation of a WMP. For example:

- Impairments from legacy mining operations that were never covered by permits are a priority in some Upper Peninsula watersheds;
- Impairments from legacy forestry operations that were never covered by permits are a priority in some Northern Michigan watersheds; and
- Alterations to natural stream morphology caused by dams and dam failures are a priority in some watersheds.

Michigan's NPS Program does not deal with all NPS threats to Michigan's waters. For example, long-range atmospheric transport of persistent, bioaccumulative, toxic pollutants such as mercury, PCBs, dioxins and furans, chlordane, and other banned and canceled pesticides are beyond the scope of this program. Mercury and PCB deposition are being addressed in statewide TMDLs for Michigan's inland waters. In addition, contaminated sediment issues are better addressed by other state and federal programs.

Objective II-1: Develop, update and encourage the use of BMPs to eliminate or control NPS pollutants and causes of impairments.

The NPS Program promotes the use of BMPs to control NPS pollution. In addition, the NPS Program continually supports the development and implementation of new BMPs. Typically, BMPs are structural, vegetative, or managerial conservation practices that reduce or prevent detachment, transport, and delivery of NPS pollutants to surface or groundwater. The NPS Program relies on several BMP manuals and actively works to update these manuals and keep information current.

Agricultural BMPs*:* The NPS Program utilizes the USDA, NRCS, *Field Office Technical Guide* for BMPs intended to reduce or prevent detachment, transport, and delivery of NPS pollutants from agricultural sources. In addition, the NPS Program works with the NRCS and other partners to design and test new BMPs to control agricultural inputs.

Strategy

II-1-A: Continue to work with the NRCS, MDARD, and others to identify and develop new agricultural BMP standards and specifications, and incorporate the cost-effectiveness of implementing agricultural conservation practices in Michigan's watersheds.

Short-term Action

II-1-A-1: The NPS Program will continue to work with the Michigan Livestock Wastewater Workgroup to develop effective and affordable practices to address milking parlor/milk house wastewater, and polluted runoff from areas such as feedlots, and silage storage bunkers. The workgroup consists of partners from the NRCS, MSU, MDARD, Michigan Milk Producers Association, the Clinton Conservation District, and the Michigan Land Improvement Contractors of America. The goal is to develop standards for the new practices that can be incorporated into the NRCS *Field Office Technical Guide* and implemented with cost-share through Farm Bill programs.

Forestry BMPs*:* The NPS Program worked with the MDNR, Forestry Division, to develop the *Sustainable Soil and Water Quality Practices on Forest Land*. This document identifies BMPs intended to reduce or prevent NPS pollution resulting from forestry practices and describes responsible actions necessary to maintain high water quality.

Strategy

II-1-B: Continue to look for opportunities to work with the MDNR, Forestry Division, to develop new Forestry BMPs.

Urban BMPs: The NPS Program led efforts to produce the *EGLE Best Management Practice Manual (*formerly titled *Guidebook of Best Management Practices for Michigan Watersheds)*. This document is a compilation of BMPs that can be used to address NPS pollution from a variety of urban settings including construction-sites and large recreational areas. The NPS Program will continue to look for opportunities to develop and update BMPs. The NPS Program intends to review 20 percent of all existing BMP Manual content with the goal that no portion of the BMP Manual will ever be more than five years old, without at least having been reviewed.

Strategy

II-1-C: Update and maintain the *EGLE Best Management Practice Manual.*

- The NPS Program will continue to work with Part 91, SESC, Storm Water Program staff and other partners to identify, develop, and maintain new BMPs, standards, and specifications.
- The NPS Program will compile existing research focusing on the cost effectiveness of select urban conservation practices such as cluster development, LID, and selected urban BMPs over traditional practices.

Short-term Action

II-1-C-1: The NPS Program staff will work with WRD wet-weather staff and external partners to continue updating the EGLE Best Management Practice Manual. By October 1 of each year, at least 20 percent of the existing BMPs will be reviewed and either updated and republished on the NPS Program Website, or, removed from the Manual.

The impact of climate change on BMPs

Climate change has the potential to exacerbate NPS related sources and causes of impairments. In addition, climate change has the potential to impact the effectiveness of BMPs.

Climate change is addressed in more detail in Section II-12. That section includes a strategy and short-term actions to address the effectiveness of BMPs.

Objective II-2: Address causes of hydrologic alteration of water bodies and watersheds.

The NPS Program will work to address the causes of hydrologic alteration of water bodies and watersheds. The *National Water Quality Inventory: 2000 Report to Congress* lists hydrologic modification as a source of water quality impairment in 20 percent of rivers and streams nationally and 18 percent of lakes, ponds, and reservoirs. Hydrologic modification can be caused by a number of activities including dams, channelization of streams to facilitate drainage, or land use practices like impervious surfaces and storm drains that result in increased surface water runoff. Altering the hydrology of a water body or watershed can increase soil erosion and sediment loads resulting in impaired aquatic life. The NPS Program will focus on the causes of hydrologic alteration listed below. As part of this effort, NPS Program staff will favor a systematic approach targeted to address priority sites and causes of hydrologic instability in the watersheds. This includes targeting causes of hydrologic instability in the upper reaches of an impaired watershed first.

Land use change (especially urbanization) that increases the rate, volume and timing of runoff: Altering land use can change the hydrology of a watershed by increasing the volume of storm water runoff and reducing base flows during dry periods resulting in stream channel instability. Unnaturally high stream flow and volume during wet weather events can lead to an increase in channel erosion, loss of aquatic habitat and increased flooding. Decreased base flow in dry weather can lead to sediment deposition and loss of habitat for aquatic life. The NPS Program will look for opportunities to restore designated use impairments by encouraging the implementation of BMPs to address altered hydrology by retaining and infiltrating storm water.

Channelization of streams to facilitate drainage: Michigan has developed more than 35,000 miles of public drains serving more than 17 million acres of agriculture and urban areas. These drains were designed and are managed to improve agricultural productivity and reduce flooding. However, drainage systems alter natural hydrology which in some cases causes stream bank erosion and loss of habitat for aquatic life. The NPS Program will look for opportunities to reconnect natural flood plains or create two-stage ditches to restore natural stream functions, reduce soil erosion, and improve habitat for aquatic life.

Dams and undersized stream crossings: Anthropogenic flow obstructions change the natural morphology of the stream by changing stream dimensions, flow velocities, and sinuosity. Dams and undersized stream crossings impound water and do not allow for the natural movement of sediment through the watershed. In addition, soil erosion can be unnaturally high below dams and undersized culverts. The NPS Program will look for opportunities to removing unnatural flow obstructions to reduce soil erosion and restore natural stream functions.

The NPS Program will consider the use of program funds for portions of dam removal projects that will contribute toward improvements in water quality. Activities eligible for Section 319 or matching funds include:

- Pre-removal engineering designs for dam deconstruction and stream restoration.
- Analysis of reservoir sediment samples for contaminants, as necessary to generate the removal design.

- Stream channel restoration or stabilization practices following, or performed in conjunction with, dam removal.
- Pre- and post-removal monitoring, especially to assess sediment and hydrologic impacts or biological changes.

Section 319 or matching funds will not be used to deconstruct existing dam structures, to stabilize or remove contaminated sediments, or on dam removal projects that will not address in-stream water quality problems.

Wetland loss: Wetlands can play a significant role in the protection of the natural hydrology of a watershed by providing storage during wet weather events and recharging groundwater that provides base flow during dry weather. Wetlands also reduce pollutant loads by sequestering nutrients and sediment. The NPS Program will focus efforts on restoration of lost or impaired wetlands and the protection of existing wetlands. The NPS Program will use the LLWFA to prioritize wetland restoration and protection protects.

Stream enclosures: Stream enclosures eliminate the biological and geomorphic processes provided by natural stream channels. Enclosed streams provide limited habitat for aquatic life and no flood plain access. The NPS Program will look for opportunities to daylight enclosed streams and restore natural functions to those streams.

The NPS Program encourages the use of existing federal, state, and local programs as well as selection and implementation of appropriate BMPs through development and implementation of WMPs. Some of the state and federal programs used to address urban sources include Phase I and Phase II storm water permits and the SRF. In addition, ordinances are a powerful tool for local governments. Some communities in Michigan have passed ordinances requiring that the hydrologic regime is maintained after development.

Strategy

II-2-A: Support the development of WMPs to identify and prioritize sites and BMPs to address the causes of hydrologic alteration of water bodies and watersheds. Funding and technical support will be provided to implement priority BMPs designed to control hydrologic alteration of watersheds.

Short-term Actions

II-2-A-1: The NPS Program will place a priority in the RFP for pass-through grant projects to restore or protect water bodies by addressing hydrologic alteration of watersheds.

II-2-A-2: The NPS Program staff will continue to provide technical assistance to watershed stakeholders to implement projects designed to control hydrologic alteration of watersheds.

Strategy

II-2-B: Continue to develop tools and BMPs to establish or reconnect flood plains, control runoff and stabilize stream channels.

Short-term Action

II-2-B-1: The NPS Program staff will continue to work with stakeholders to collect data to improve regional reference curves for Michigan's streams.

Strategy

II-2-C: Provide hydrology and stream morphology training to NPS Program staff, other agency staff, consultants, municipal staff, and watershed managers.

Short-term Actions

II-2-C-1: The NPS Prgram will continue to provide training such as bankfull indicator training to EGLE staff, consultants, drain commissioners, and others.

II-2-C-2: The NPS Program will continue to implement the geomorphology training plan (*Stream Geomorphology Training for the NPS Program*). Tasks include obtaining outside training for a core group of NPS Program experts and introductory or intermediate training for all NPS Program staff.

II-2-C-3: NPS Program staff will continue to look for opportunities to provide training to local watershed groups and other stakeholders. The purpose of the training will be to introduce the topics of stream morphology and hydrology to NPS project administrators and local watershed groups involved in developing and implementing WMPs.

Strategy

II-2-D: Strengthen relationships with County Drain Commissioners to work toward a better drainage maintenance program that will enable Drain Commissions to meet drainage needs while minimizing negative water quality impacts.

Short-term Action

II-2-D-1: NPS Program staff will continue to work with County Drain Commissioners and intercounty drainage boards on projects to restore modified drainage ways to a more natural state.

Objective II-3: Eliminate or reduce agricultural NPS pollutants and causes of impairment

Michigan's 47,000 farms and the commodities that they produce, contribute $13 billion annually to the State's economy. The total land area in agricultural production is nearly 10 million acres, which comprises over 29 percent of the land in the state. Corn and soybean production consist of 4.5 million acres and there are 17,000 farms with livestock.

While agricultural production activities occur statewide, the majority of agricultural production occurs in the southern half of the Lower Peninsula. The major potential NPS pollutants impacting water quality from agricultural operations are sediment, nutrients, pesticides, and pathogens. The primary agricultural sources of sediment are cropland erosion caused by tillage practices, and streambank erosion caused by increased flows due to increased runoff and livestock access. The primary agricultural sources of nutrients are misapplied (improper method, rate, or timing of application) commercial fertilizer and manure. Runoff from livestock/poultry operations (feedlot, milk house waste, silage), including runoff from misapplied manure applications, can result in degraded water quality and habitat.

Targeted and comprehensive approach to farm conservation planning

To be most effective, agricultural BMPs must be implemented in a comprehensive, systematic manner, and targeted to critical areas of the watershed. Agricultural sources of NPS pollution from particularly sensitive areas in a watershed can have a disproportionally large impact on water quality and the idea that targeted approaches can improve outcomes is not new. Therefore, critical locations where nutrient and sediment losses occur within watersheds must be identified and targeted. In addition, practices that are not implemented in a coordinated fashion may not yield optimal results. The installation of BMPs must be viewed holistically so

that practices are installed in a comprehensive manner and work together to maximize efficiency.

The NPS Program will encourage the use of the following NRCS practices as the highest priority Agricultural BMPs. NPS Program staff will advocate for EQIP application scoring and selection processes that favor these practices. Also, the NPS Program will place a higher priority on financial and technical assistance efforts that favor these practices. Use of these practices will address nutrients, sediment, and bacteria sources related to agricultural operations:

1. Nutrient Management (590)
2. Cover Crop (340)
3. Residue and Tillage Management, no-till/strip till (329)
4. Drainage Water Management (554)
5. Filter Strips (393)
6. Wetland Restoration (657)
7. Access Control (472) – to restrict/limit livestock access to surface waters

Other agricultural BMPs may be a priority on a case by case basis. In those cases, priority will be determined based on recommendations developed as part of approved nine element WMPs.

Strategy

II-3-A: Encourage the use of a targeted, comprehensive systems approach when selecting agricultural BMPs needed for implementation, in order to maximize pollutant reductions and water quality benefits.

Short-term Action

II-3-A-1: The NPS Program will include language in the pass-through grant RFP that places a higher priority on proposals that require the implementation of a system of the highest priority agricultural BMPs. Priority projects funded with Section 319 or matching funds must meet the following criteria:

- Priority projects to address sediment and nutrients from cropland (where there is no manure application) must implement (at a minimum) the following NRCS practices on all farms receiving grant or matching funds:
    1. Nutrient Management (590)
    2. Residue and Tillage Management, no-till/strip till (329)
    3. Cover Crops (340)
    4. Filter Strips (393)
- The landowner may already be implementing some of the practices and agree to implement the remaining practices as part of a grant or match funded project.
- Grant funding is only available for implementation of new practices, including the required practices listed above or other new practices that are needed to restore and/or protect water quality provided that the required practices are also being implemented. Other practices will be selected on a case-by-case basis after considering the causes and sources described in the WMP; the high priority recommendations from the WMP; and the anticipated outcomes described in the grant application.

Livestock Management Strategies

The application of manure from livestock operations should be based on agronomic need and focused on utilizing manure as a substitute for commercial fertilizer. When manure is misapplied in excess amounts, in critical areas, on frozen fields or shortly before precipitation events, it may result in the transport of nutrients or *E. coli* to water bodies. Excessive manure inputs may result in partial or total body contact advisories; fish kills and other impacts to aquatic life; nuisance algal growths; and other designated use impairments. In addition, uncontrolled livestock access to water bodies, uncontrolled runoff from livestock feeding or production areas, and inputs from other heavy use or high traffic areas can impair designated uses.

Strategy

II-3-B: Encourage the targeted and comprehensive implementation of practices to control nutrient, pathogen, and sediment inputs from livestock operations and manure applications.

Short-term Action

II-3-B-1: The NPS Program's pass-through grant RFP will place a priority on projects addressing nutrients and bacteria from manure application if the following practices are implemented (at a minimum) on all farms receiving grant funds:

- Comprehensive nutrient management plan (includes no manure application on frozen or snow-covered fields)
- Controlled/restricted livestock access to surface waters
- Residue and tillage management, no-till/strip till
    - For summer or fall manure applications, if tillage is needed for manure incorporation, a cover crop will be planted and no tillage will occur the following spring.
    - For spring applications of manure, if tillage is needed for manure incorporation, then no tillage shall occur the previous summer/fall and a cover crop will be planted during the previous summer/fall.
- Filter Strips

CAFOs requiring permits will only be eligible to receive grant funds for practices that are above and beyond the CAFO permit requirements.

Long-term Utilization of Cover Crops and No-till/Strip-till Practices to Improve Soil Health and Water Quality

Cover crops, along with reduced tillage practices such as no-till and strip tillage, are two critical agricultural practices for reducing soil erosion and nutrient loses from crop fields. In addition, these practices are key to improving the soil health in crop fields. Soil health is not only important from a crop production perspective, it can also have a positive effect on water quality. As the soil health of a crop field improves, the potential for soil and nutrient loss is reduced. However, it make take several years to demonstrate effectiveness. Farmers implementing cover crops and reduced tillage practices for a year or two are not likely to see the benefits and may be less likely to adopt these practices permanently.

Strategy

II-3-C: Encourage the long-term use (five or more years) of cover crops and no-till/strip-till practices to protect and improve water quality, along with maintaining and improving the soil health of crop fields.

Short-term Actions

II-3-C-1: NPS Program staff will include language in the pass-through grant RFP that places a higher priority on proposals that promote and implement the long-term use of cover crops and no-till/strip till practices.

II-3-C-2: NPS Program staff will encourage the used of multiple grant and cost-share programs to provide cost-share for up to five years for cover crops and no till/strip till practices.

Advanced Nutrient Management Strategy

While many water quality related agricultural practices try to treat runoff and/or prevent existing nutrients in crop fields from impacting water quality, advanced nutrient management strategies attempt to reduce the amount of nutrients in the crop field that are susceptible to leaving the field and entering surface water or groundwater. Advancements in technology allow for better definition of the crop nutrient needs throughout a field, placing nutrients in the field where and when the crop need them, reducing overlap of nutrient application and improving the efficiency of nutrient uptake by the crop. Some examples of advanced nutrient management practices are: grid soil sampling (down to 2.5-acre or 1-acre grids), variable rate fertilizer/manure application, GPS yield monitors, planter upgrades to achieve proper seed singulation, spacing and appropriate down force for uniform crop emergence, individual row shutoffs for fertilizer application, and maintaining appropriate soil pH levels to maximize crop nutrient uptake.

Strategy

II-3-D: Encourage the use of advanced nutrient management strategies to target and minimize nutrient applications based on crop need and to maximize opportunity for crop nutrient uptake, in order to reduce the potential for nutrient loses from cropland to surface waters and groundwater.

Short-term Action

II-3-D-1: The NPS Program will include language in the pass-through grant RFP that places a higher priority on proposals that promote and implement advanced nutrient management practices.

Cover Crop Management Strategy

Cover crops are one of the primary practices related to improving soil health and reduces the potential for water quality impacts from sediment and nutrients. Multi-species cover crops including species that will not winter kill provide more benefits to soil health and water quality than single-species cover crops or cover crops with no species that will survive the winter.

Strategy

II-3-E: Encourage the use of multi-species cover crops including at least one species that will not winter kill.

Short-term Action

II-3-E-1: The NPS Program will include language in the pass-through grant RFP that places a higher priority on proposals that promote multi-species cover crops with at least one species that will not winter kill.

Drainage Water Management Strategies

The drainage water management strategy is focused on managing the flow of water from fields that have already tiled as opposed to installing new systems to drain lands for crop production. Managing agricultural drainage water in Michigan can provide benefits such as; conserving subsoil moisture, increasing productivity on tile drained fields and reducing nutrient loading to surface waters. Drainage water management can reduce loadings of nitrates and soluble reactive phosphorus to surface waters and works most effectively on flat or very gently sloped fields with slopes of 0.5 percent or less. Nitrate losses from tile-drained fields have been reduced by 15 percent to 75 percent depending on location, climate, soil type, and cropping system. Most of the reduction resulted from the reduction in water flow from the field through the tile.

Strategy

II-3-F: Encourage the use of drainage water management practices, to address the surface water quality impacts of nutrients and hydrology contributions from tile-drained farm land.

Short-term Actions

II-3-F-1: NPS Program staff will work with local Conservation Districts to promote drainage water management strategies. This could include demonstration-sites in priority watersheds, educational sessions for farmers, and providing cost-share for the installation of tile line control structures.

II-3-F-2: NPS Program staff will include language in the pass-through grant RFP that will give priority to watershed proposals that promote drainage water management strategies. Priority will be given to proposals in watersheds with appropriate soils and slopes as well as nutrient impairments or flow related impairments caused in part by tile line inputs.

Collaborate with other stakeholders to address agricultural NPS pollution

The WRD works in partnership with a number of organizations or programs to address agricultural NPS pollution. The WRD works in partnership with the MDARD to identify and correct impairments caused by agricultural sources through the Right to Farm Memorandum of Understanding between EGLE and MDARD and by monitoring the effectiveness of agricultural programs. In addition, the NPS Program supports MDARD's MAEAP by funding technical support for local stakeholders via pass-through grants. Also, pass-through grants to County Conservation Districts and other stakeholders are used to implement agricultural BMPs. Finally, NPS Program staff participate on NRCS committees and provide input on the implementation of Farm Bill programs.

Strategy

II-3-G: Support the implementation of NPS controls on agricultural land by providing technical and financial assistance and through collaboration with stakeholders.

Short-term Actions

II-3-G-1: NPS Program staff will continue to provide advice upon request to the NRCS as they work to implement the National Water Quality Initiative. This includes advice regarding priority watersheds, eligible BMPs, and critical areas within those watersheds.

II-3-G-2: NPS Program staff will collaborate with agricultural stakeholders through participation on the NRCS's Michigan Technical Committee, EQIP sub-committee, Conservation Reserve Program/CREP sub-committee, and Wetland Restoration Program sub-committee. In addition,

NPS staff will provide information to direct Farm Bill funding such as lists of impaired waters and lists of NPS Program priority watersheds.

Objective II-4: Reduce or eliminate NPS pollution from urban sources.

The NPS Program will work in partnership with stakeholders to reduce or eliminate NPS pollution from urban sources. Over 82 percent of Michigan's residents live in metropolitan areas. The 2003 *Michigan Land Use and Leadership Council's* report, indicated that Michigan on average developed its land eight times faster than its population grew. The report generally found land use policies that were sprawling and overly land consumptive. Increasing the impervious footprint by developing greenspace has negative impacts on the quality and quantity of runoff delivered to surface waters. The NPS Program will address the negative impacts of impervious surfaces by reducing the volume of storm water runoff to levels typical of undeveloped land in the watershed and by eliminating pollutants carried in storm water runoff.

The expansion of urban infrastructure produces impervious surfaces that are viewed as one of the dominant factors associated with urban hydrology. Impervious surfaces alter the hydrology of an area by preventing the infiltration of precipitation into the soil and removing vegetation that intercepts and absorbs rainfall and slows runoff. This results in a greater portion of a precipitation event being converted to overland flow increasing the stream's flow rate and volume associated with each event and decreasing base flows during periods of dry weather. Increased surface runoff flowing into rivers contributes to stream channel instability resulting in stream bank erosion, habitat loss, and flooding. In addition, impervious surfaces act as a collector and conveyance system for many NPS pollutants including sediments, nutrients, pathogens, other anthropogenic contaminants including deicers, and debris.

The impacts of impervious surfaces on aquatic life have been well documented. Impacts to sensitive species (such as brook trout) have been documented in watersheds with as little as 4% impervious surfaces. The Center for Watershed Protection predicts that most stream quality indices decline when watershed impervious cover exceeds 10 percent with severe degradation occurring beyond 25 percent impervious surface. Connecticut's Eagleville Brook TMDL established a target of 12 percent impervious cover to restore aquatic life communities. MDNR's Fisheries Division identified the impact of flashy wet weather events and low base flow during dry periods on the highly urban Rouge River system. They emphasized the need for both storm water detention and infiltration to rehabilitate Rouge River fish communities.

The NPS Program encourages the use of existing federal, state, and local programs as well as selection, siting and implementation of appropriate BMPs through development and implementation of WMPs. Some of the state and federal programs used to address urban sources include Phase I and Phase II storm water permits, CSO and SSO control, NPDES permits, SESC, Construction Storm Water, and the SRF. In addition, ordinances are a powerful tool for local governments. Some communities in Michigan have passed ordinances requiring soil erosion control and predevelopment hydrologic regime after development. Also, a statewide ban on phosphorus in lawn fertilizer has been adopted to reduce phosphorus loads to water bodies.

GI

GI uses vegetation, soils, and natural processes to manage water in a way that mimics the natural hydrology of an area. At the landscape level, GI consists of public and private natural assets, with and without public access, located in both urban and rural areas. GI is considered to be a natural life support system — an interconnected network of waterways, wetlands, woodlands, wildlife habitats, and other natural areas; greenways, parks, and other conservation

lands; working farms, ranches, and forests; and wilderness and other open spaces that support native species, maintain natural ecological processes, sustain air and water resources, and contribute to the health and quality of life for communities and people. These areas can intercept rain and absorb storm runoff to help maintain the natural hydrologic response of a watershed to the stream.

GI applied at the local level for storm water management is often referred to as LID and includes rain gardens, porous pavements, green roofs, infiltration planters, trees and tree boxes, and rainwater harvesting for non-potable uses. These techniques are designed and applied to mimic natural functions that infiltrate, evapotranspire, capture and treat storm runoff to maintain or help restore natural hydrology, and improve water quality.

The use of LID and other GI techniques can reduce stress on traditional water drainage infrastructure (storm sewers and combined sewers) which are typically extensive networks of underground pipes and/or surface water channels in cities, towns, and suburban areas. Properly applied and located, GI has the potential to reduce the frequency of CSOs and SSOs, and provides other environmental benefits.

Michigan's NPS Program promotes the use of LID and GI to eliminate NPS pollution in the following ways:

- Partnering with local governments and other watershed stakeholders to develop WMPs that use both large- and small-scale LID and GI measures to control the quality and quantity of storm water runoff, and thereby improve water quality and stream channel stability.
- Providing technical assistance to stakeholders on-site selection, pre-design site investigation, BMP design, and implementation of specific GI techniques.
- Developing criteria for design and application of GI and LID techniques. In 2008, NPS Program staff partnered with SEMCOG to develop the Low Impact Development Manual for Michigan which provides design information for specific LID practices. This document is provided as guidance for Michigan communities and other watershed stakeholders applying LID practices.
- Promoting the application of EGLE Wetlands Program GIS based LLWFA to identify and prioritize existing and historic wetlands for protection, enhancement or restoration based on the ecological or water quality functions they can provide. Specific wetlands identified by the LLWFA can then be included in WMPs and linked to NPS tools to estimate load reductions.

Strategy

II-4-A: Promote the inclusion and implementation of GI and LID techniques in WMPs to achieve reductions of both NPS pollution and storm water volume.

Short-term Action

II-4-A-1: The NPS pass-through grant RFP will place a priority on LID and GI projects targeted to critical areas within watersheds impaired by altered hydrology. A special emphasis will be placed on projects that:

- Contribute to reducing storm water runoff by restoring the site specific, pre-settlement hydrologic response at up to the 2-year, 24-hour event.

- Demonstrate innovative runnoff capture techniques to restore the site specific, pre-settlement hydrologic response up to the 2-year, 24-hour event on sites with limited or no infiltration capacity.

Strategy

II-4-B: Provide technical assistance to communities and watershed groups conducting pre-design site investigation, design and application of GI and LID practices. A priority will be placed on technical assistance to expand the use of GI techniques in dense urban areas that provide significant challenges to implementation.

Short Term Actions

II-4-B-1: NPS Program staff will look for opportunities to provide technical assistance to and promote the use of GI projects in urban areas which will result in storm water flow reductions to CSOs based on meeting pre-settlement hydrologic response.

II-4-B-2: NPS Program staff will look for opportunities to provide technical assistance to local programs that perpetuate the use of LID and GI BMPs to reduce storm water runoff from individual sites such as Master Rain Garden programs.

Objective II-5: Reduce or eliminate NPS pollution from transportation sources.

In 1985, the MDNR and MDOT jointly published the *Strategy for Reduction of NPS from Transportation-Related Activities in Michigan*, which documents the scope of the transportation-related NPS problem and the types of pollutants of concern. As of 2000, Michigan had nearly 120,000 miles of roadway at the state, county, and local levels. An estimate of the amount of impervious area these roadways represent is 0.4 percent of the entire state for roadways only (not including parking lots or other facilities). Possibly the largest and most severe impacts are from improperly designed or maintained road stream crossings. However, other impacts are caused by eroding embankments from upland runoff, perched culverts causing plunge pools, undersized culverts causing bank erosion, and horizontally misaligned culverts causing bank erosion.

EGLE's *Best Management Practices Manual* includes BMPs that deal specifically with transportation-related sources of NPS impacts. In addition, the NPDES Storm Water Program deals with construction-related runoff, including transportation projects from sites that have a point source discharge to waters of the state. Under the current program, construction-sites that are one to five acres in size must comply with all requirements of the NPDES Storm Water Program. Construction-sites greater than five acres in size must also apply for a Notice of Coverage. All construction-sites covered by the NPDES Storm Water Program must also comply with the SESC Program.

The NPS Program will continue to identify and address NPS threats from transportation sources through the development and implementation of WMPs, and work in partnership with the various agencies that are involved in or have an interest in road stream crossings. These agencies include the following: (1) EGLE, WRD (reviews permit applications for new or replacement crossings and determines the minimum flow that crossings must pass without adverse effects); (2) MDNR, Fisheries Division (fish passage and habitat); (3) MDOT; and (4) county road commissions (install most road stream crossings).

Strategy

II-5-A: Protect and restore waters of the state through control of NPS pollution from transportation-related sources.

Short-term Action

II-5-A-1: NPS Program staff will provide technical assistance to stakeholders working on transportation infrastructure projects such as the I-75 corridor improvement project and other projects as they arise.

Objective II-6: Reduce or eliminate NPS pollution from forestry sources.

Michigan has 19 million acres of timberland covering 51 percent of the state. Nonindustrial private owners are the predominant Michigan timberland owners. Private timberland ownership is spread among 312,500 individuals. Ownership is broken out as follows:

- Private Individual: 46 percent
- Private Corporate: 11 percent
- National Forest: 14 percent
- Forest Industry: 8 percent
- State: 20 percent
- County, Municipal, and Other (Tribes, National Parks, etc.): 1 percent

Several existing programs currently address NPS pollution from forestry practices. The Sustainable Forestry Initiative is a voluntary program developed by the forestry industry and administered by an independent Sustainable Forestry Board. This program requires independent and internal audits to ensure compliance with WQS. Also, the Forest Stewardship Council is a nonprofit organization that promotes an environmental, social, and economically sustainable approach to forest harvesting. Audits of forest practices are conducted by Forest Stewardship Council-certified entities.

The NPS Program will work to eliminate NPS pollution from forestry practices. Water quality impacts from forestry practices remain a significant issue primarily in the northern Lower Peninsula and the Upper Peninsula. The NPS Program will continue to provide updated BMP manuals and education to this target audience through coordination with the MDNR and other partners. Also, the NPS Program will continue to address forestry sources of NPS pollution through the development and implementation of WMPs.

Strategy

II-6-A: Protect and restore waters of the state through control of NPS pollution from forestry activities targeting these efforts through development and implementation of WMPs and expansion of partnerships.

Short-term Action

II-6-A-1: The NPS Program's UP District Staff will participate on Michigan's Sustainable Forestry Initiative Implementation Committee. The committee is charged with developing and overseeing the annual monitoring program and auditing forestry BMPs. NPS Program staff participation will improve implementation and monitoring of forestry BMPs.

Objective II-7: Reduce or eliminate NPS pollution from improperly functioning on-site wastewater treatment systems.

A significant and growing percentage of homes and businesses in Michigan are not served by public water or public sewer. It is estimated that statewide there may be as many as 1.4 million individual on-site wastewater systems. It is also estimated that over 50 percent of new homes and businesses will rely upon on-site wastewater systems and individual wells. This higher

percentage of new construction served by on-site systems is consistent with the higher rates of growth exhibited by nonmetropolitan areas in Michigan. EGLE programs involving individual on-site systems include review and approval of subdivisions and condominiums not served by public sewer and/or water and nonresidential on-site wastewater systems utilizing subsurface dispersal with flows up to 10,000 gallons per day. These activities are conducted in partnership with LHDs. EGLE also conducts periodic reviews of local health on-site wastewater programs as part of the Local Public Health Accreditation Program and administers contracts with LHDs amounting to over $5 million annually, funding a significant but insufficient portion of local on-site wastewater programs. A secure long-term state funding mechanism for the conduct of EGLE on-site wastewater program activities does not exist.

It is estimated that the volume of on-site sewage disposed of annually in Michigan is 112 billion gallons, or 308 million gallons per day. This is based on the current number of systems and a flow of 220 gallons per day of wastewater per system, which is believed to be a realistic figure supported by actual flow monitoring.

LHDs that are actively conducting a mortgage evaluation or an inspection at the time of a real estate transaction, report a wide variation in failure rates ranging up to 23 percent. The rather wide variation is explainable when considering differences in geology, age of the community, proportion of year-round homes, and stringency of regulations. For instance, areas with older homes having systems installed prior to permits being required by LHDs are more likely to have higher rates of failure. On a statewide basis it is presently speculated that approximately 10 percent (i.e., 140,000) of all systems may be experiencing problems at any point in time, equating to an estimate of 31 million gallons per day discharged into failing systems. Annually, LHDs issue repair/replacement permits for an estimated 12,000 systems, reflecting a significant number of unidentified systems that may be failing.

Improperly managed on-site wastewater systems present public health concerns and on-site systems are cited as significant contributors to impairment of surface waters due to discharge of pathogens and nutrients. On-site systems also contribute to contamination of groundwater and wells relied upon as drinking water sources. Many of Michigan's designated use impairments are caused by pathogens. Failing on-site septic systems are often identified as significant sources. Michigan has developed a statewide *E. coli* TMDL to more efficiently deal with the large number of water bodies impacted. The NPS Program will support efforts to implement the statewide *E. coli* TMDL. As part of this effort, the NPS Program will consider a variety of approaches to help stakeholders find and fix failing on-site septic systems including enforcement approaches, financial support, and education and outreach. The NPS Program will place a priority on efforts to help stakeholders using comprehensive approaches (including regulatory and incentive-based initiatives).

Strategy

II-7-A: Use WMPs to support stakeholder efforts to develop and implement comprehensive approaches to address water quality issues caused by failing on-site septic systems.

Short-term Action

II-7-A-1: The NPS Program will encourage LHDs and other stakeholders to include specific on-site septic recommendations in new or updated WMPs covering water bodies with impairments or threats caused by failing on-site septic systems. The NPS Program will encourage recommendations to support comprehensive approaches with a mix of regulatory and voluntary actions.

Regulatory Approaches

Michigan has no statewide sanitary code. Development of a statewide sanitary code for on-site wastewater treatment is one component of a comprehensive plan to protect waters of the state. Passage of a statewide sanitary code would strengthen and standardize regulatory oversight of on-site wastewater treatment systems. In the interim, the NPS Program will work with LHDs to strengthen their county sanitary codes and programs.

Strategy

II-7-B: Continue to support LHDs in regulating on-site wastewater treatment systems.

Short-term Action

II-7-B-1: The NPS Program will continue investigating and taking compliance/enforcement actions related to community-wide failure of on-site wastewater treatment systems in watersheds where this issue is a priority. These actions support efforts of the LHDs by identifying and addressing the need for a more comprehensive community-wide approach to wastewater treatment.

Financial Approaches

Michigan does not have a dedicated financing mechanism to provide grants or loans to address individual failing septic systems. Several states utilize a linked deposit program through their SRF to direct low interest loan funding to individuals through local lenders (banks) for repair of failing septic systems. The linked deposit program is a mechanism for financing certain projects. Instead of borrowing directly from the SRF, a linked deposit loan is made to the applicant by a private lending institution. The below-market interest rate for the loan is supported by an SRF certificate of deposit with the lender. However, legislative action would be required in Michigan to develop a linked deposit system.

The NPS Program will place a priority on assisting stakeholders actively working to find and fix failing on-site septic systems. This includes providing grant funding to: (1) repair or replace failing on-site septic systems, as long as the repair or replacement is part of a comprehensive approach to address water quality issues caused by failing on-site septic systems; and (2) to support other efforts to implement a comprehensive approach. A comprehensive approach includes efforts to identify critical reaches or individual homes with failing septic systems; initiating compliance or enforcement action independently to fix systems known to be failing; and providing voluntary incentives to encourage maintenance, repair or replacement in critical areas identified as part of approved WMPs.

Strategy

II-7-C: Support local efforts to develop comprehensive approaches to addess failing on-site septic systems.

Short-term Actions

II-7-C-1: The NPS Program will use the following criteria to determine the eligibility and priority of Section 319 and CMI pass-through grant funds to repair or replace failing on-site septic systems as part of a comprehensive approach to address designated use impairments:

- The on-site wastewater treatment system is causing impairment. The system must be within an impacted critical area specifically identified in an approved nine-element WMP. Also the plan must identify water bodies where WQS are not being met due to failing on-site wastewater treatment systems. Priority will be given to areas where correction of

failing on-site wastewater treatment systems will result in measurable water quality improvement.

- The on-site wastewater treatment system is not within an area suspected or already identified as having a concentrated community-wide problem with failing on-site wastewater treatment systems (that would best be resolved with a centralized wastewater treatment system). Determinations regarding the eligibility of an area to receive grant funding will be made by NPS program staff on a case-by-case basis.
- The county or local unit of government, where the on-site wastewater treatment system is being repaired/replaced has a point of sale ordinance. Or, the county or local unit of government are implementing a comprehensive approach to find and fix failing on-site septic systems; the comprehensive approach includes enforcement of existing authorities to replace known failing septic systems; and the county or local unit of government has a record of taking enforcement actions to address known failing systems.
- Prior to implementing septic system repairs or replacement at a site, all failing septic systems identified through the watershed planning process have been formally referred to the LHD for parallel regulatory follow-up.
- The homeowner agrees to sign a 20-year maintenance agreement to ensure the septic system will be operated and maintained appropriately.

II-7-C-2: Proposals for NPS grant funded monitoring or technical assistance (such as the development of on-site septic databases) to identify failing on-site septic systems will be a higher priority when accompanied by a comprehensive approach to addressing failing on-site septic systems.

Education and Outreach

Homeowner education is one of the most common approaches to addressing impacts caused by failing on-site septic systems. The NPS Program will continue to provide technical assistance and funding for education and outreach activities.

Strategy

II-7-D: Continue to support homeowner education and awareness of technical and financial options related to on-site wastewater treatment systems.

Short-term Action

II-7-D-1: The NPS Program will look for opportunities to fund information and education activities, identified as high priority activities in approved WMPs, to address impairments caused by failing on-site septic systems.

Objective II-8: Reduce or eliminate NPS pollution and causes of impairment from recreational activities.

NPS pollution affects recreation and is caused by certain types of recreation. Bathing beaches are sometimes impacted by NPS pollution; whereas marinas, off-road vehicles, and golf courses can be sources of recreational NPS pollution. Michigan has many different programs and laws that monitor and regulate these types of activities, as well as voluntary approaches to educate individuals and organizations about recreational NPS pollution.

On a statewide basis, recreational activities cause a relatively small number of water quality impairments. However, within individual watersheds, recreational activities may be an important

source of NPS pollutants. The NPS Program deals with recreational sources through development and implementation of WMPs.

Marinas

Michigan leads the nation in the boating business with more than one million registered boats; 40 percent of Michigan residents are boaters. Michigan currently has approximately 750 licensed marinas on inland lakes and streams and connecting channels (St. Marys, St. Clair, and Detroit Rivers) of the Great Lakes and 81 marina leases for marina operations on the Great Lakes. The marinas vary from large, full-service, commercial facilities to small residential operations where only slips are provided. The largest concentrations of marinas and recreational boating facilities (such as public access launch sites) are found in large rivers or drowned river mouths that are navigable to the Great Lakes and/or connecting channels. These are often located in or near urban settings where intensive waterfront development has already occurred or where pressure to develop is great. Most new marina development on inland lakes has been residential facilities to service subdivision or condominium associations.

Possible NPS impacts from marinas include:

- Toxic agents, such as metals, pesticides, biocides, and antifouling agents associated with marine paints can accumulate in sediment, marine plants, and animals and are persistent in the marine environments.
- Antifreeze sinks in water and settles in the sediment. Even in low doses, ethylene glycol is hazardous to humans, animals, and marine life.
- Oil and gas dissolve slowly in water and accumulate on particles in marine sediment. When disturbed, the sediment will release these contaminants, which are toxic to marine plants and animals. Some ingredients are carcinogenic and can cause mutations and birth defects.
- Most cleaning products, including household detergents and soaps, act as dispersants, contain mercury, and accumulate in sediment. They are toxic to marine plants and animals, impair breathing in fish, reduce oxygen in the water, and produce foam on water surfaces.

The Michigan Clean Marina Program encourages marinas to develop technically sound and economically achievable approaches that minimize environmental impact and reduce the generation of waste. This public-private partnership includes three primary organizations: (1) the marina industry (Michigan Boating Industries Association); (2) academic institutions (MSU and the University of Michigan via the Michigan Sea Grant College Program); and (3) federal and state government (NOAA, National Sea Grant, and EGLE).

Off-Road Vehicles

Michigan's public Off-Road Vehicle trails offer thousands of miles of single and double track riding opportunity. These trails are lightly groomed and riders are likely to encounter narrow sand trails, rough moguls, steep hills, stumps, rocks, brush, loose surfaces, and other hazards.

Indiscriminate Off-Road Vehicle use has damaged fragile ecosystems on both public and private lands. Complaints of erosion on hills and trails, destruction of stream banks and beds, and conflicts with other users have led to more restrictive rules to control Off-Road Vehicle abuses.

Golf Courses

There are over 975 golf courses in Michigan. The state ranks among the national leaders in total number of golf courses and number of golf courses per capita. Numerous regulatory programs oversee the erosion control and wetland impact issues related to construction of golf courses in Michigan. Water quality issues related to runoff from golf courses is regulated under Part 31, Water Resources Protection, of the NREPA. The principal approach to addressing these NPS runoff issues in Michigan, however, is a voluntary program, the Michigan Turfgrass Environmental Stewardship Program, which was launched in June 1998.

Outdoor Recreationists

Over 25 million campers visit Michigan's park system each year with the majority of use during the June through August time frame. There are approximately 100 state parks with over 14,000 campsites in Michigan; many along the shorelines of the Great Lakes. The state ranks first in the United States for total number of sites and overnight attendance.

The MDNR offers hundreds of miles of trails and pathways used primarily for bicycling, hiking, and cross country skiing (some also allow horseback riding and snowmobiling). These trails provide scenic routes through the Michigan countryside, running by rivers and through forests or farm country, connecting small communities and many state forest campgrounds.

Foot traffic from unmanaged recreational access sites can cause streambank erosion. The NPS Program has funded implementation of BMPs at recreational access sites to reduce erosion to the water bodies and demonstrate these practices.

Strategy

II-8-A: Protect and restore waters of the state through control of NPS discharges caused by recreational activities, targeting these efforts through development and implementation of WMPs.

Objective II-9: Reduce or eliminate NPS pollution and causes of impairment from resource extraction activities.

EGLE is responsible for assuring that the development of fossil fuel and mineral resources follows sound conservation principles and incorporates proper protection for other natural resources, the environment, property, and public health and safety. EGLE regulates the drilling and operation of wells used for oil and gas production, exploration and production of brine and other minerals, and underground storage and disposal. EGLE regulates the operation and reclamation of mines for industrial sand, metals, and other minerals. EGLE also develops and distributes a variety of maps, publications, and data on fossil fuels, minerals, and groundwater for industry and public use.

Resource extraction practices were not always well regulated. Water bodies located in portions of the Upper Peninsula were significantly impacted by past mineral extraction practices and continue to be impaired. On a statewide basis, resource extraction activities cause a relatively small number of water quality impairments. However, within individual watersheds, impacts caused by past practices may be an important source of NPS pollutants. The NPS Program deals with these historical sources through the development and implementation of WMPs.

Strategy

II-9-A: Protect and restore waters of the state through control of NPS discharges caused by resource extraction activities, targeting these efforts through development and implementation of WMPs and in coordination with existing regulatory and voluntary programs.

Objective II-10: Reduce or eliminate NPS pollution and causes of impairment from land disposal activities.

In Michigan, several different agencies are involved with overseeing proper waste management. State agencies include EGLE. Federal agencies include the USEPA and the United States Department of Transportation. In addition, local entities, including wastewater treatment plant authorities, local fire departments, and county health departments may have jurisdiction.

Land disposal of waste materials is sufficiently regulated in Michigan to address most NPS issues. The NPS Program will continue to address impacts caused by waste disposal activities through the development and implementation of WMPs. Remediation projects intended to address landfill leachate will not be supported with Section 319 or matching funds. However, the NPS Program will encourage local watershed groups to seek alternative sources of funding such as the SRF.

Strategy

II-10-A: Protect and restore waters of the state through control of NPS discharges caused by unpermitted land disposal of waste materials, targeting these efforts through coordination of existing regulatory and voluntary programs, and development and implementation of WMPs.

Objective II-11: Reduce or eliminate excessive sediment sources that impair or threaten aquatic life or alter stream morphology.

Clean sediments, from upland erosion and stream bank erosion, are a significant source of pollution to Michigan's rivers and lakes. Excessive sedimentation damages in-stream habitat, decreases aquatic organism survival and reproduction, reduces primary productivity, and alters stream channel morphology. Excessive sedimentation is also the causative agent identified in many aquatic biota TMDLs.

The NPS Program has funded, and will continue to fund, projects that reduce clean sediment loadings from both upland and in-stream sources, including bank stabilization, livestock exclusion, upland agricultural practices, and the creation of in-stream sand traps and certain storm water practices (e.g., detention and retention basins, storm water infiltration BMPs, etc.). The NPS Program does not fund the maintenance of sand traps, maintenance of storm water BMPs, or dredging projects in ponds, lakes, or streams.

A complication in executing projects to reduce clean sediment loadings is to correctly identify both the scale of the problem and its cause, since these factors influence selection of appropriate BMPs. For example, a bank erosion problem due to a local problem like cattle access can be addressed with a local BMP like fencing, while bank erosion due to a large-scale problem like altered hydrology caused by watershed-scale urbanization can only be addressed with a large-scale BMP(s). The NPS Program has guidance to help grantees identify the scale of a sedimentation problem and will continue to advocate the use of these tools for all sediment load reduction projects.

Strategy

II-11-A: Continue to fund projects that reduce clean sediment loadings to wetlands, streams, and lakes. When addressing sources of excess sediment from unstable stream channels, the NPS Program will emphasize the correction of the underlying cause of the erosion, such as hydrologic alteration and channelization, before implementing measures to stabilize the channel and bank erosion directly.

Objective II-12: Identify and track NPS threats and causes of impairment due to climate change and respond to those threats.

Climate change in Michigan is expected to result in significantly higher average temperatures and more frequent, large, precipitation events. Additionally, it is anticipated that precipitation patterns will shift, with more precipitation occurring in the late winter and spring, falling as rain instead of snow, when soils are often saturated and many farm fields lack vegetation. A corresponding decrease in precipitation is expected during the summer, potentially leading to more frequent drought conditions. Precipitation projections vary for different areas of the state as well, with wetter conditions anticipated in the north. However, the predictions for precipitation changes are less certain than those for temperature and vary more significantly from one geographic area to another.

Overall, rainfall may not be sufficient in some areas of the state to compensate for the drying effects of a warming climate. This will likely lead to lower stream flows and lake levels in the summer, lowering water levels below shoreline habitat such as wetlands and fallen trees, depriving some species of important habitat needed for survival. In some cases, the loss of these absorbent filters in the riparian zone will increase the potential for pollutants to enter the water bodies.

Warming temperatures are expected to shift vegetation species ranges north, leading to the replacement of cold weather species with those tolerant of warmer conditions. Between 1990 and 2006, plant hardiness zones shifted about half a zone northward. The composition of forests in the Great Lakes region is changing with many tree species shifting northward while being replaced by more southerly varieties. As changes in vegetation occur, loss of vegetation along stream banks could exacerbate erosion, reduce filtering of runoff, and contribute to increases in water temperature due to the loss of an overhead canopy.

In the aquatic environment, warmer weather is expected to decrease the amount of coldwater streams in Michigan and native species adapted to coldwater streams may disappear. Water bodies in general may be more susceptible to invasive species as well as increased occurrences of nuisance population levels of both plants and algae. It is anticipated that the length of summer stratification in many inland lakes will increase, producing a greater risk of oxygen depletion. Such anoxic conditions could also mobilize sediment-bound phosphorus, perhaps making BMPs that reduce phosphorus delivery to water bodies even more important in the future.

The changing climate is likely to change the design criteria for some BMPs implemented through Michigan's NPS Program. For instance, the use of some vegetative species for BMPs and natural channel design may no longer be appropriate. The NPS program will determine appropriate design criteria to provide the control expected from BMPs and other control measures as climate changes. The BMPs used and promoted by Michigan's NPS Program will be designed, implemented and evaluated accounting for the projected changes in temperature, precipitation, and vegetation patterns. Guidance documents produced and updated by the NPS program will provide criteria to account for climate change in BMP design.

When selecting BMPs to control NPS pollution, it is important to keep in mind the difference between mitigating climate change effects, versus adapting to those effects. The design or use of many BMPs will require adaptation to a new climate in order that they continue to function as intended. BMPs cannot effectively mitigate climate change but some may be able to reduce exposure to the hazard of climate change. An example would be the increased use of infiltration along coldwater streams to reduce or slow the magnitude of temperature change in that stream. Adaptation reduces the vulnerability to the hazard of climate change. One

example would be planting some warm-weather tree varieties in a greenbelt to increase the chance that some species will survive as the climate changes. Another example would be sizing road culverts and stream crossings larger to accommodate predicted larger precipitation events. BMPs should be implemented to prevent the exacerbation of instabilities and other water quality problems caused by a changing climate.

Strategy

II-12-A: Develop and update design criteria for BMPs, particularly rainfall and vegetation criteria, to ensure expected performance as climate change occurs, and apply the criteria to appropriate BMPs.

Short Term Action

II-12-A-1: NPS Program staff will consider climate change performance in routine updates of all BMP design documents as those documents are updated.

Strategy

II-12-B: Given that weather and environmental conditions can vary substantially from one area of Michigan to another, much of the responsibility for selecting and implementing appropriate BMPs will be coordinated through the implementation of local WMPs.

Stakeholders involved in the development of WMPs have requested help preparing plans that consider the impacts of climate change on efforts to restore and protect water quality as climate change occurs. While the predicted impacts of climate change vary among areas of the state, a few general concepts that stakeholders should consider are listed below. Some of these concepts (e.g., GI and buffer strips) are high priority activities for the NPS Program and are covered in more detail elsewhere in the NPS Program Plan. Other activities (such as removing dams to reduce surface area impounded) may be locally important but would not be considered for NPS funding.

- Expand the use of GI and LID to (1) reduce summer storm water runoff of warm water into surface waters, and (2) enhance groundwater recharge to provide more coolwater input to surface waters.
- Increase riparian tree canopies to decrease the amount of direct solar radiation heating surface waters, wetlands and floodplains.
- Remove dams that no longer serve their purpose to reduce the surface area of impounded river water warmed by solar radiation in the summer.
- Design storm water related infrastructure large enough to accommodate increased storm water and river flows from predicted increases in precipitation over the life of the practice.
- Expand the use of buffer strips to filter increased storm water runoff before it reaches surface waters.
- Protect and restore wetlands and floodplains to rivers to absorb storm water runoff to: (1) minimize the magnitude of streambank erosion from high flow stream events, and

(2) increase the amount of groundwater recharge to streams during the low-flow summer period. Minimize development and conversion of wetlands and floodplains.

- Install rain barrels at buildings to reduce storm water runoff rate and volume for stream channel protection. Also, rain barrels can provide irrigation water for nearby vegetation, particularly during the summer.
- Increase the use of conservation easements to reduce storm water runoff and soil erosion, while preserving groundwater recharge.
- When installing a new greenbelt or enhancing/expanding an existing one, use a diverse set of plant species paying particular attention to those species with the ability to survive warmer, longer and drier summers, yet are also able to withstand longer periods of saturated spring soil. A diverse plant assemblage is also important to help mitigate the impacts of anticipated increases in pest populations and the arrival of new pests due to a warming environment.
- Encourage the concept of using "the right plant for the right place." This could include drought tolerant native species in exceptionally sunny, dry locations to minimize the need for summer irrigation.
- Plant more trees to increase the acreage of forested land cover, which protects against soil erosion and minimizes storm water runoff, while enhancing groundwater recharge and sequestering carbon from the atmosphere.

Short-term Action

II-12-B-1: NPS Program staff will work with local partners as needed when WMP updates are prepared to encourage the consideration of potential climate change impacts when selecting BMPs.

Objective II-13: Prevent the spread of invasive species during the implementation of activities to restore impaired waters and protect high quality waters from NPS threats.

Michigan's aquatic ecosystems are negatively impacted by AIS that are already present and the state's waters are continually threatened by new invasions. The introduction of AIS into state waters has had a significant negative effect on natural resources, human health, and recreational opportunities. Also, AIS and terrestrial invasive species can have significant economic impacts on waterfront property values, tourism, utilities, and other industries.

NPS Program staff and stakeholders have opportunities to minimize the risk of spreading invasive species during the course of implementing activities to reduce NPS pollutant sources and causes of impairment. Examples include:

- Conducting monitoring in upstream areas before downsteam areas to decrease the likelihood of carrying species farther up into the watershed or visiting the least invaded sites before invaded sites during monitoring trips.
- Before moving between sites, perform basic decontamination steps such as:
    - Visually inspecting and removing any plants or mud from footwear.
    - Visually inspecting and removing and properly disposing of any plants and mud from field equipment and vehicles.
    - Draining all water from boats and equipment prior to leaving the site and before entering a new water body.

    - Thoroughly drying boats and equipment between sites.
    - Disinfecting boats and equipment between sites.
- Using only native plants and seed for restoration and BMPs.

In addition, the WRD is asking all stakeholders to be on the look for invasive species that have a limited distribution or are not yet known to be established in Michigan. A "Watch List" of Michigan's high priority AIS and instructions for reporting sightings are available on the MDNR's Website.

Strategy

II-13-A: Minimize the risk of spreading terrestrial and aquatic invasive species during the implementation of measures to address NPS pollutant sources and causes of impairment.

Short Term Actions

II-13-A-1: The NPS Program will add language to all NPS pass-through grants requiring grantees to take appropriate steps to minimize the risk of spreading terrestrial and aquatic invasive species.

II-13-A-2: The NPS Program will not fund pass-through grant projects that propose to use invasive species as part of their BMPs. BMP site plans that include vegetation must include species lists that will be reviewed against lists of invasive exotic species (such as *Michigan Invasive Plant Species*, *A Field Identification Guide to Invasive Plants in Michigan's Natural Communities*, and *A Field Guide to Invasive Plants of Aquatic and Wetland Habitats for Michigan*). Native species will be promoted and the use of invasive exotic species will be prohibited in grant-funded projects.

CHAPTER 5: INFORMATION AND EDUCATION

Goal III: Increase public awareness of NPS pollutants and causes of impairments and encourage individuals to adopt behaviors to reduce NPS pollutants and causes of impairments.

While surveys indicate a growing awareness of NPS issues and specific BMPs, many people still do not comprehend how their daily actions and individual decisions contribute to NPS pollution. Effective information and education efforts have been shown to raise knowledge and awareness leading to changes in social norms which are the precursor to changes in behavior. Changed behavior such as implementation of managerial or physical BMPs will eventually result in reduced NPS pollution and improvements to water quality.

Confirming that awareness and attitudes are changing and behaviors are being adopted in a watershed through social monitoring is one way to demonstrate interim progress toward meeting WMP goals prior to measurable water quality improvements. Monitoring social indicators, like monitoring environmental indicators, will provide valuable information about how well management strategies are working. A well-crafted evaluation process will provide a mechanism for continuous improvement of an information and education program and help determine whether objectives have been achieved.

The NPS Program's information and education strategy will focus on developing an informed and engaged public, as well as providing clear guidance and direction to address specific pollutants, sources and causes. The information and education strategy will include a variety of methods and messages to target specific audiences as well as methods for evaluating the success of outreach efforts to motivate behavior change that will restore and protect our rivers and lakes from NPS pollution impacts. The issues, audiences and solutions vary across the state so specific actions will focus at a statewide, regional, and local watershed scale as appropriate. The information and education activities will include developing and distributing education materials, sponsoring workshops/trainings, providing assistance, evaluating progress, and building partnerships.

Objective III-1: Help stakeholders become aware and engaged in protecting surface and groundwater from NPS pollution.

The challenges of finding guidance, technical support, or financial assistance to address NPS problems can be overwhelming for watershed stakeholders. The information may be complicated to understand, scattered in numerous locations, unclear in the objectives, or out-of-date. It is therefore important that the educational tools provided by the NPS Program be current, relevant, and provided in a readily accessible manner. Educational efforts will connect stakeholders with tools specific to their issues utilizing different available methodologies.

Strategy

III-1-A: Maintain a multimedia collection of information and education outreach materials for distribution to watershed groups, grantees, and other stakeholders.

Short-term Actions

III-1-A-1: Each fiscal year, NPS Unit staff will identify publications that are still relevant and determine which should be updated. Out-of-date materials will be retired or updated and produced for distribution as resources allow. Relevant materials in short supply will also be reprinted as resources allow.

III-1-A-2: NPS Unit Staff will review I&E grant products and identify those that could serve a larger audience and make them available on the NPS I&E page or, if resources allow, as hard copies.

Strategy

III-1-B: Look for opportunities to develop partnerships for training to integrate program process and messages.

Short-term Actions

III-1-B-1: NPS Program staff will partner with other organizations and agencies to provide statewide trainings specifically related to watersheds, (such as the Michigan Water Environment Association's Watershed Summit, the Shoreline and Shallows Conference, and the Inland Lake Convention) or specific NPS pollution sources (storm water and shoreline erosion for example).

III-1-B-2: NPS Program staff will work with local stakeholders in targeted watersheds with approved WMPs to identify and implement priority information/education recommendations to reduce NPS pollutants.

Objective III-2: Communicate effectively to provide clear guidance and direction to stakeholders.

The NPS Program is complex and communicating program goals and guidance is critical to program success. Different methodologies are used to describe how the program components are connected, provide a consistent message, and communicate expectations so that staff and stakeholders know their roles and how their contributions fit.

Strategy

III-2-A: Maintain a Website with accurate up-to-date information. This will include specific information covering grant administration, technical information, and guidance on topics such as: land use planning and zoning; environmental and storm water ordinances; water quality BMP design and implementation; and water quality information and education materials from around the state.

Short-term Action

III-2-A-1: Each year, NPS Program staff will review and update the Website to ensure that information is current.

Strategy

III-2-B: Communicate clearly regarding program goals, objectives, resources, and services utilizing traditional and new technological methods.

Short-term Actions

III-2-B-1: The NPS Unit will annually develop a series of webinars to educate stakeholders about the NPS Program priorities and pass-through grants.

III-2-B-2: NPS Program staff will develop and deliver presentations to educate staff and stakeholders about NPS issues.

Objective III-3: Monitor the effectiveness of information and education activities to determine program and project success.

Social monitoring is necessary to assess attitudes and conditions in the social, economic and political structures that impact decisions related to water quality. This monitoring is an important

part of efforts to target outreach towards the intended audience, and measure the effectiveness of efforts to change knowledge and behavior regarding NPS pollution.

The USEPA, Region 5, has teamed with the Region 5 State NPS Programs and the six Land Grant Universities to develop methods for measuring social change regarding watershed projects and evaluate state and local activities regarding watershed education. A key charge to this work group was to create a tool kit for local governments, watershed groups, and other stakeholders to use to conduct social monitoring. The SIDMA tool kit includes a spatial analysis tool with key demographic data, samples of surveys, samples of QAPPs, and themes or messages for watershed outreach. NPS grantees began using the tool kit in 2009 and the NPS Program expects that future grant-funded programs that include social monitoring tasks will use the protocols.

The SIDMA tool was developed by MSU with support from a Section 319 pass-through grant from EGLE. SIDMA will be used to build locally appropriate surveys, analyze and compare survey results among watersheds, and quantify NPS social indicator status. MSU will maintain this system allowing for continued access and updates to the SIDMA system. In addition, the Region 5 Social Indicators Workgroup developed SIPES to help stakeholders plan and implement social monitoring projects.

NPS programs within each Region 5 state have agreed to support social indicators in the following ways:

- Work closely with project staff to help them understand which steps in the SIPES apply to their projects.
- Help project staff determine what types of mid-project evaluations are necessary.
- Help stakeholders collect data using the SIPES protocols.
- Communicate with USEPA and the regional social indicators team on refining and improving SIPES.
- Begin using social indicator data as part of their state program evaluation framework to help identify opportunities to improve program impacts.
- Consider long-term monitoring approaches and opportunities for using social indicators.

Strategy

III-3-A: Work in partnership with the USEPA Region 5 and Social Indicators partners to provide statewide, regional, and local measures for evaluating the effectiveness of educational efforts. Social monitoring will be based on SIPES protocols and SIDMA will be the primary tool for social measure.

Short-term Actions

III-3-A-1: On an ongoing basis, the NPS Unit staff will provide guidance on social monitoring to NPS Staff and watershed stakeholders. Examples of this guidance includes: assistance in developing grants/contracts, reviewing QAPPs, assistance during the survey process, and reviewing the final analysis.

III-3-A-2: NPS Unit staff will continue to work with the USEPA Region 5 and Social Indicators partners to promote a social monitoring tool kit to help stakeholders collect, in a consistent manner, social indicators and other pertinent information of targeted audiences. The NPS information and education coordinator will continue to provide input to the USEPA.

Strategy

III-3-B: Continue to communicate program successes and the benefits of improved water quality achieved through NPS pollution control.

Short-term Action

III-3-B-1: The NPS Program will develop two information and education success stories each year. These success stories will be posted on EGLE's NPS Website. Success stories could be instances where there is a document increase in knowledge or change in behavior that positively impacts water quality, or where work on a project spurs others to follow up and address NPS water pollution. These success stories will be reported to the USEPA by October 1 of each year.

CHAPTER 6: FUNDING

Goal IV: Efficiently manage pass-through grants and help stakeholders identify funding sources to restore and protect watersheds.

Since 1988, EGLE has utilized an annual award from the USEPA under the CWA, Section 319, to fund Michigan's NPS Program. This is the primary source of NPS funding for most state agencies and constitutes approximately $4.6 million annually for Michigan. With this, Michigan funds NPS staff throughout the state to provide technical and administrative support to the program and grantees. Approximately 50 percent of the Section 319 grant funds are provided competitively to non-federal units of government (counties, cities, townships, and villages), public and private colleges and universities, regional planning agencies, and incorporated nonprofit organizations to develop and implement WMPs.

Some federal CWA water quality planning funds, under Sections 205(j), are also used by the NPS Program to provide pass-through grants for planning projects.

Complementing the federal NPS funds are CMI bond funds. The CMI was approved by Michigan voters in November 1998 and included $50 million for NPS pollution control grants. These CMI NPS grants have been made available through a competitive pass-through process like the Section 319 grants, and whenever possible, the two funds are coordinated into one RFP process and set of awards.

Each of the Michigan NPS pollution control grants requires matching funds as specified in the RFP. For example, watershed planning grants (when available) require a 15 percent minimum match, while watershed implementation projects require 25 percent minimum match. The sources of match have included grants from other entities, foundation funding, in-kind services, time and labor from consultants and other partners, donations from local businesses, donated volunteer time, and "bargain sales" for conservation easements.

Objective IV-1: Efficiently select and manage 319 and CMI-NPS pass-through grants to provide support to stakeholders to restore and protect watersheds

Strategy

IV-1-A: Continue to administer a pass-through grants program with the goal of providing support to eligible entities to develop and implement WMPs.

Short-term Actions

IV-1-A-1: By June 1 of each year, NPS Staff will identify WMP development and implementation priorities consistent with the NPS Program Plan. These priorities will favor projects that yield measurable in situ improvements resulting in the restoration of water bodies or projects that result in long-term protection of water bodies.

IV-1-A-2: By October 1 of each year, the NPS Program will release a pass-through grant RFP with priorities consistent with the NPS Program Plan as well as applicable Section 319 and CMI funding restrictions.

IV-1-A-3: NPS Program staff will provide technical and administrative assistance to grant applicants.

IV-1-A-4: NPS Program staff will review proposals each year and select the projects that best meet the RFP criteria and priorities.

IV-1-A-5: The NPS Program will administer pass-through grants. This includes administration of the Section 319, CMI, 205(j), GLRI, and state license plate funded projects. NPS Program staff will do the following tasks:

- The NPS project administrators will provide assistance to each grantee to ensure that projects are successfully implemented.
- The NPS Program district staff will provide technical assistance to potential applicants and grantees in coordination with unit staff.
- The NPS Program engineers will provide technical assistance, review, and approve (as appropriate) all BMP plans to be implemented with grant funds.
- The NPS Monitoring Coordinator will provide technical assistance with the development and implementation of grant-funded environmental monitoring. In addition, the NPS Unit Chief will approve all QAPPs for grantee environmental monitoring prior to initiation of monitoring projects.
- The NPS I&E Coordinator will provide technical assistance with the development and implementation of grant funded social monitoring. In addition, the NPS Unit Supervisor will approve all QAPPs for grantee social monitoring prior to initiation of monitoring projects.
- NPS Program staff will provide technical assistance in the area of hydrology and stream morphology to grantees.
- The NPS Program financial analysts will work with project administrators and assist grantees with the financial aspects of grants administration and ensure that appropriate payments are made.

IV-1-A-6: NPS staff will continue to improve the NPS sub-grant project selection process by reviewing the process on an annual basis and incorporating recommended changes as needed. This will include periodic reviews to verify that the grant administrative requirements for Section 319 and CMI funded grants are appropriate for both staff and grantees given the requirements of similar grant programs within EGLE.

IV-1-A-7: NPS Project Administrators will meet quarterly or as needed to discuss grant administration issues, develop new or revise existing forms, policies or procedures to reflect changing program needs.

Objective IV-2: Provide technical support to other state grant and loan programs to eliminate or reduce NPS pollutants and causes of impairments.

SRF: The Green Project Reserve (typically under the Green Infrastructure category) portion of the SRF provides low-interest loans to local municipalities to address NPS pollution issues. Applications must be consistent with an approved WMP and Michigan's NPS Program Plan submitted to the USEPA. However, the use of SRF loans for NPS activities is underutilized in Michigan compared to other states. The SRF program has been used in other states to fund the correction of on-site/decentralized wastewater treatment, agricultural cropland conservation practices, stream hydromodification BMPs, forestry BMPs, groundwater remediation, and urban storm water BMPs. In addition, other states have used SRF loans to supplement their grants program and EQIP dollars.

Strategy

IV-2-A: Look for opportunities to use NPS SRF loans to eliminate or reduce NPS sources of pollution.

Short-term Actions

IV-2-A-1: NPS pass-through grant RFPs and RFP announcements will include a link to the SRF Program and NPS staff will forward applicable SRF funding annoucnements and information to NPS stakeholders.

IV-2-A-2: NPS Program staff will review and score SRF-NPS loan applications and review site plans upon request and as resources allow.

Other state grant funds: The State of Michigan awards grants and loans for a variety of activities related to NPS pollution control. Examples include the dam removal grants administered by the MDNR; Coastal Grants by the Coastal Zone Management Program; SAW grants and loans administered by EGLE, Office of Drinking Water and Municipal Assistance; and monitoring grants administered by EGLE, WRD.

Strategy

IV-2-B: Continue to look for opportunities to coordinate funding with other pass-through grant programs within EGLE and other state agencies.

Short-term Action

IV-2-B-1: NPS Program staff will continue to review applications for other state grants. NPS Program staff will assist with SAW plan development as resources allow.

Objective IV-3: Provide technical support to other federal grant programs intended to eliminate or reduce NPS pollutants and causes of impairment.

The NPS Program works with various federal agencies to leverage and coordinate funds. For example, the MDOT's Transportation Enhancement Program offers a variety of federal transportation-related grants including grants for projects to implement environmental mitigation to address water pollution due to highway runoff and the NPS Program continues to look for opportunities to coordinate with them.

The NPS Program works with the NRCS and the Farm Service Agency to leverage and coordinate federal Farm Bill dollars that have the potential to address agricultural-related NPS water quality issues. This includes having input on the spending priorities for the EQIP funds for Michigan; annual involvement in the selection of watersheds to receive Conservation Security Program funding; input into the Wetland Reserve and Conservation Reserve Programs; and providing assistance to stakeholders developing and implementing Regional Conservation Partnership Program grants.

In addition, to providing input into the selection of priorities for federal grant RFPs, the NPS Program reviews grant applications for other programs with similar objectives. For example, NPS Program staff reviewed National Fish and Wildlife Federation grant proposals and Great Lakes Commission soil erosion control grant proposals.

NPS staff also administers several GLRI grants and provide technical assistance to outside entities managing GLRI nonpoint source grants.

Strategy

IV-3-A: Continue to work with federal, state, and local entities to coordinate and leverage federal grant funds to maximize water quality restoration and protection.

Short-term Actions

IV-3-A-1: NPS Program staff will continue to coordinate efforts to provide RFP priorities for federal pass-through grant programs (such as EQIP). The recommended RFP priorities will be

consistent with the NPS Program's priorities related to controlling NPS pollution to protect or restore water quality.

IV-3-A-2: NPS Program staff will continue to review RFPs and grant applications for federal grant funds (such as the Great Lakes Commission's Sediment and Nutrient Reduction grants) and recommend projects that best meet the NPS Program's priorities related to controlling NPS pollution to protect or restore water quality.

IV-3-A-3: NPS Program staff will continue to pursue funding for and provide administration of NPS-related GLRI grants awarded from the USEPA, and provide technical assistance to other agencies receiving NPS grants in Michigan, as appropriate.

IV-3-A-4: NPS Program staff will continue to assist with the development and implementation of Regional Conservation Partnership Program grants upon stakeholder requests and as resources allow. Participation could include participating in stakeholder meetings and seeking USEPA approval to use Section 319 and CMI grant projects as match.

Objective IV-4: Work with Stakeholders to implement portions of Michigan's Hazard Mitigation Plan

Michigan's Hazard Mitigation Plan was developed by the Emergency Management and Homeland Security Division of the Michigan State Police to provide a framework for hazard mitigation within the state. This plan was updated in 2014 and covers a large range of human-caused and natural disasters including riverine flooding. Michigan's Hazard Mitigation Plan documents the economic impacts of serious flooding that is exacerbated by anthropogenic hydrological modifications. The Hazard Mitigation Plan describes several mitigation strategies for riverine and urban flooding. Many of which are consistent with water quality strategies described in Chapter 4 (Source Control Strategies) of Michigan's NPS Program Plan and consistent with the highest priority recommendations in approved WMPs. Examples from the Hazard Mitigation Plan (pages 184 to 185) include:

- Flood plain (and coastal zone) management: planning acceptable uses for areas prone to flooding (through comprehensive planning, code enforcement, zoning, open space requirements, subdivision regulations, land use, and capital improvements planning) and involving drain commissioners, hydrologic studies, etc., in these analyses and decisions.
- Acceptable land use densities, coverage and planning for particular soil types and topography (decreasing amount of impermeable ground coverage in upland and drainage areas, zoning, and open space requirements suited to the capacity of soils and drainage systems to absorb rainwater runoff, appropriate land use, and capital improvements planning) and involving drain commissioners, hydrologic studies, etc., in these analyses and decisions.
- Employing techniques of erosion control within the watershed area (proper bank stabilization, techniques such as planting of vegetation on slopes, creation of terraces on hillsides, use of riprap boulders and geotextile fabric, etc.).
- Protection (or restoration) of wetlands and natural water retention areas.
- Structural projects to channel water away from people and property (dikes, levees, floodwalls) or to increase drainage or absorption capacities (spillways, water detention and retention basins, relief drains, drain widening/dredging or rerouting, debris detention basins, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, wetlands protection and restoration).
- Farmland and open space preservation.

- Employing techniques of erosion control in the area (bank stabilization, planting of vegetation on slopes, creation of terraces on hillsides).
- Purchase or transfer of development rights to discourage development in floodplain areas.
- Storm water management ordinances or amendments.
- Wetlands protection regulations and policies.

Federal hazard mitigation grant funding is available for eligible entities including state agencies, Indian tribal governments, local units of government, and private non-profit organizations with FEMA-approved hazard mitigation plans.

Strategy

IV-4-A: Encourage eligible applicants to leverage FEMA funding for hazard mitigation projects that also provide water quality benefits.

Short-term Actions

IV-4-A-1: NPS Program staff will add a link to Michigan's Hazard Mitigation Plan and FEMA's Hazard Mitigation Assistance Unified Guidance document on the NPS Website and in the annual NPS Program RFP.

IV-4-A-2: NPS Program staff will look for opportunities to provide technical assistance to stakeholders applying for or implementing FEMA hazard mitigant grant projects that also provide water quality benefits.

Strategy

IV-4-B: Look for opportunities to collaborate with Michigan State Police staff charged with developing and implementing the Hazard Mitigation Plan.

Short-term Actions

IV-4-B-1: NPS Program staff will look for opportunities to collaborate and coordinate with the Michigan State Police's Emergency Management and Homeland Security Division and look for NPS Program staff training opportunities.

IV-4-B-2: NPS Program staff will look for opportunities to provide technical assistance to Emergency Management and Homeland Security Division as they work to implement or update the Hazard Mitigation Plan.

Objective IV-5: Work in partnership with foundations to support local watershed groups.

Watershed organizations struggle to maintain sustainable funding for staff that solely focuses on implementing watershed plans, providing technical support to municipalities, and providing information and education support. Some organizations have been able to accomplish this through the establishment of endowment funds, membership dues, grants, donations, and local fundraising events.

In addition, local watershed groups have benefited from the support of foundations. The NPS Program will identify opportunities to work in partnership with foundations to support local watershed groups. The Council of Michigan Foundations produces a directory of over 2,500 foundations that give money in Michigan. This directory can be purchased online at https://www.michiganfoundations.org/.

Strategy

IV-5-A: Work to improve relationships with foundations, both locally and at the statewide level.

Short-term Actions

IV-5-A-1: Saginaw Bay District NPS staff will continue to work with the Bay Area Community Foundation on development of the Saginaw Bay Watershed Restoration Fund.

IV-5-A-2: Saginaw Bay District NPS staff will continue to work with the Saginaw Bay Watershed Initiative Network in their proposal development and review process to address NPS pollution in the context of sustainable communities.

CHAPTER 7: COMPLIANCE AND ENFORCEMENT

Goal V: Support compliance and enforcement efforts to restore and protect priority watersheds

There are instances where water quality impacts can be directly attributed to a specific NPS. In these cases, EGLE staff work with the landowner or responsible party or refer the situation to the proper agency to address the problem and obtain compliance with state environmental laws. If the responsible party does not satisfactorily address the problem and its cause, it may be appropriate for EGLE to take enforcement action to protect Michigan's water resources.

Objective V-1: Provide technical assistance to regulatory programs as appropriate to increase compliance effectiveness.

Strategy

V-1-A: Provide assistance to regulatory programs.

Short-term Actions

V-1-A-1: NPS Program staff will provide geomorphology and natural channel design expertise to Part 301, Inland Lakes and Streams, of the NREPA, permit staff upon request.

V-1-A-2: NPS Program staff will consult with Parts 31, Water Resources Protection; Part 91, Soil Erosion and Sedimentation Control; Part 301, Inland Lakes and Streams; and Part 303, Wetlands Protection, of the NREPA, staff before developing or updating BMPs.

V-1-A-3: Staff in the Saginaw Bay District Office will annually document communities with identified problems due to failing on-site wastewater treatment systems and report corrective actions taken.

Objective V-2: Provide technical assistance to enforcement efforts to increase effectiveness.

Strategy

V-2-A: Provide assistance to enforcement staff building cases to address impairments caused by NPS pollutants.

Short-term Action

V-2-A-1: NPS Program staff will provide technical assistance to enforcement staff upon request.

Objective V-3: Investigate complaints related to NPS pollution or water quality impacts.

Strategy

V-3-A: Citizen complaints regarding nonpoint source related water quality issues will be investigated and follow-up actions taken.

Short-term Action

V-3-A-1: NPS Program staff will investigate nonpoint source related water quality complaints delivered by citizens directly to staff or via the Pollution Emergency Alerting System. Staff will take appropriate follow-up actions that may include public outreach to stakeholders on NPS or other issues.

CHAPTER 8: MONITORING

Goal VI: Focus monitoring to document impairments and threats to high quality waters, and assess the effectiveness efforts to restore and protect priority watersheds.

Accurate problem identification and effectiveness monitoring are necessary to target NPS pollution control efforts and link NPS pollution control activities with changes in water quality. In addition, organizations funding NPS control efforts desire more confirmation that these activities are making a difference in water quality, especially since significant amounts of money and time have been, and will continue to be, spent at the local, state, and federal levels to address NPS problems.

In September 2004, EGLE completed the *Nonpoint Source Environmental Monitoring Strategy*. The strategy describes how Michigan's water monitoring programs support the pollution control efforts of the NPS Program. The strategy describes how the NPS monitoring priorities are set, how monitoring is used to track improvements in water quality following implementation of NPS control actions, and how the monitoring results are communicated and used in program decisions.

The strategy groups NPS monitoring into four broad categories for discussion purposes: (1) statewide trend monitoring; (2) problem identification monitoring; (3) TMDL development and effectiveness monitoring; and (4) NPS control effectiveness monitoring. The strategy also identifies and describes the various NPS monitoring tools used by EGLE and its contractors. A key part of the strategy is a description of how monitoring results are conveyed to resource managers and the public, and how study conclusions are used in NPS Program decision making. The NPS Program Plan incorporates recommendations from the monitoring strategy.

Objective VI-1: Identify NPS monitoring priorities, plan monitoring studies and report results.

Priority setting and planning activities include evaluating available resources, establishing NPS monitoring priorities, and determining monitoring needs. Study design and implementation includes selecting specific monitoring objectives, projects, and locations; developing monitoring plans for implementation by EGLE staff; and working with grantees and contractors to develop monitoring plans and QAPPs. Data management and reporting includes storing data electronically and preparing final reports.

Strategy

VI-1-A: Establish NPS monitoring priorities and allocate NPS monitoring resources in a manner that ensures that monitoring results can be used to target future actions, measure program and project success, and make program adjustments based on lessons learned.

Short-term Actions

VI-1-A-1: The NPS monitoring coordinator will annually update the *NPS Program Multi-Year Plan* by December 31 of each year. The *NPS Program Multi-Year Plan* update will include the following elements:

1. The status of NPS Program monitoring priorities and recommendations developed to date.
2. A description of any multi-year effectiveness monitoring projects underway (including NPS related TMDL effectiveness monitoring projects) and a list of watersheds that may be targeted for short-term effectiveness monitoring projects.

VI-1-A-2: Each year EGLE'S SWAS will distribute a letter to internal and external partners seeking water quality monitoring recommendations. The NPS monitoring coordinator and NPS District staff will work with local groups to identify sites that may require future monitoring.

VI-1-A-3: Each year the SWAS staff will convene meetings to discuss monitoring needs in each of the major watersheds targeted for monitoring. Meeting participants will include NPS Program staff, SWAS monitoring staff, WRD permit staff, other WRD Program staff and EGLE's AOC staff as appropriate. Participants will discuss problem identification, TMDL, trend, and project effectiveness monitoring.

VI-1-A-4: Before March 30 of each year, SWAS managers will review all of the NPS monitoring needs, balance those needs against other WRD monitoring needs and priorities along with available funding.

VI-1-A-5: The NPS monitoring coordinator will work with grantees and NPS staff to develop and approve monitoring plans and QAPPs. The NPS Unit Chief will approve QAPPs.

VI-1-A-6: The SWAS monitoring staff and NPS Program staff will ensure that data are entered into the appropriate electronic databases including USEPA's Water Quality Exchange (WQX previously known as STORET). The NPS project administrators will ensure that contractors and grantees provide appropriate data in a WQX-ready format before a grant or contract is closed. The SWAS WQX coordinator will enter a grantee's and contractor's WQX-ready data into WQX.

VI-1-A-7: The SWAS staff reports summarizing water quality in target watersheds will include a separate section highlighting the NPS problem identification results.

Objective VI-2: Identify waters of the state that are not meeting designated uses or where designated uses are threatened due to NPS causes and sources.

EGLE implements a number of routine monitoring activities designed to assess the waters of the state on a regular basis, respond to complaints about water quality, and monitor conditions at sites with known or suspected water quality problems. Much of the problem identification monitoring is conducted on a five-year rotating basin-year monitoring schedule (Table 8.1).

Water quality measurements are compared to specific WQS that have been established in Michigan to protect surface waters for certain designated uses. Designated uses and WQS are briefly described in Chapter 2.

Most of the routine water quality assessment monitoring conducted by WRD staff includes rapid assessment techniques, such as the SWAS surveys. The SWAS surveys include biological assessments as well as water and sediment chemistry monitoring to identify impaired water bodies and causes of impairment. NPS pollution problems observed during the SWAS surveys are reported to appropriate NPS Program staff for additional monitoring or follow-up corrective action. WRD district staff responds to citizen complaints and the results of these actions are used to direct future NPS pollution control actions or additional monitoring.

Table 8.1. Five-Year rotating watershed monitoring schedule.

2020	2021	2022	2023	2024
Au Train-Chocolay	Carp (Marquette County)	Menominee	Iron	Carp (Mackinac County)
Cedar	Misery	Au Sable	Montreal	Charlotte and Upper St. Marys
Escanaba	Portage	Black (Alcona County)	Ontonagon	Millecoquins
Fishdam	Sturgeon (Houghton County)	Black (Van Buren County)	Presque Isle	Manistique
Ford	Salmon	Galien	Upper Wisconsin	Munuscong and Lower St. Marys
Rapid	Tobacco	Huron	Bear	Pendill's Creek
Sturgeon (Delta County)	Au Gres/Tawas	Looking Glass	Betsie	Pine
Whitefish	Cass	Maple	Boardman	Tahquamenon
Black (Cheboygan County)	Detroit	St. Clair	Cherry	Two Hearted
Kawkawlin-Pine	Upper Grand	Tittabawassee	Elk	Waiska
Macatawa	Muskegon	White	Flat	Big Sable
Ocqueoc	Paw Paw		Flint	Clinton
Pentwater	Red Cedar		Lake Michigan Shoreline Tribs	Lower Grand
Pere Marquette	Lower St. Joseph		Lake St. Clair Tribs	Kalamazoo
Rouge			Pigeon	Manistee
Shiawassee			Pine	Rifle
Upper St. Joseph			Platte	Saginaw
Swan			Rabbit	
Thunder Bay			Raisin	
Wiscoggin			Rogue	
			Thornapple	

Strategy

VI-2-A: Conduct problem identification monitoring to ensure that new water quality problems caused by NPS pollution are identified and corrected in a timely manner.

Short-term Actions

VI-2-A-1: Each year, EGLE will target problem identification monitoring to cover the appropriate watersheds listed in Table 8.1.

VI-2-A-2: In the event that EGLE staff discovers NPS problems on federal lands during the course of routine monitoring, staff will bring these problems to the attention of the appropriate federal agency. If that agency is unwilling or unable to address problems identified by EGLE, then EGLE will notify the USEPA.

Objective VI-3: Develop new monitoring and assessment tools and provide technical assistance to stakeholders.

The NPS Program is continually looking for new tools to help staff and stakeholders identify NPS problems and assess the effectiveness of NPS BMPs. The NPS Program is particularly interested in tools that will help stakeholders conduct watershed inventories; identify critical areas and sites; and identify critical pollutants. Also, EGLE's rapid assessment protocol, Procedure 51, is a multi-habitat semi-quantitative assessment of macroinvertebrate community composition that is frequently used to assess BMP effectiveness. However, the NPS Program recognizes that collecting more quantitative macroinvertebrate community data is useful for certain BMP effectiveness studies. More quantitative procedures, focused on sampling the habitat feature(s) most impacted by certain NPS BMPs, like stream bank stabilization or road stream crossing repairs (usually riffles), are being evaluated by the WRD.

In addition, alteration of stream hydrologic regimes resulting from large-scale land use changes is a major problem in watersheds throughout Michigan. Changes in storm water runoff rates, post-storm peak flows, and base flow discharges impact stream bank and stream bed erosion rates, in-stream habitat features, and aquatic and riparian biological communities. Many Section 319 project proposals aim to address these problems via BMPs like stream bank stabilization and stream channel restoration. Problems like bank erosion and in-stream habitat degradation can be caused by factors other than hydrologic alteration, so it is desirable to distinguish problems caused by large-scale storm water flows from those caused by local factors like livestock access or poorly maintained road stream crossings. EGLE is developing monitoring tools to address this need. This effort currently focuses on assessing the following:

- Hydrologic alteration.
- Stream geomorphic condition.
- Watershed and stream channel stability.

One manifestation of large-scale hydrologic alteration is an increase in post-storm peak flows. A common tool for assessing the magnitude of change in peak flows over time is a stream flashiness index. There are several stream flashiness indexes in the literature, and EGLE has chosen to use the R-B Index. An R-B Index value is calculated with discharge data at USGS stream gage stations for each year of record, and trends in the index values over time are assessed with regression statistics. EGLE staff have identified over 300 USGS gage stations with an appropriately long period of record, calculated R-B Index values, and performed trend analyses.

Another tool under development is stream geomorphology regional reference curves. The results of this project (graphs of drainage area versus channel width, depth, and cross-sectional area) will be used for problem identification, and for designing stream restoration projects and evaluating their success.

The flashiness index and the regional reference curves are two components of a suite of tools developed to assist NPS grant applicants to assess the scale of their perceived NPS problem. Another tool currently recommended by the NPS Program is the BANCS model which is composed of the Bank Erosion Hazard Index and Near-Bank Stress models. BANCS is a field procedure for rapidly and quantitatively assessing the condition of stream banks. Other tools, such as channel evolution models, excess shear stress calculations, and more qualitative indicators of stream condition are also being evaluated.

Strategy

VI-3-A: Continue to develop monitoring tools and provide technical support to NPS grantees, watershed groups, and other interested parties.

Short-term Actions

VI-3-A-1: The flashiness index data will be updated for all the current USGS gages every five years, with the last update completed in 2012. NPS Program staff are currently working on the 2017 update.

VI-3-A-2: On an ongoing basis, the NPS Program will support volunteer monitoring groups through technical assistance and training, as well as direct them to the MiCorps Volunteer Monitoring Program.

Objective VI-4: Assess the effectiveness of NPS restoration and protection activities.

Trend Monitoring: In 1998, EGLE began implementing a monitoring plan designed to provide a comprehensive assessment of the quality of Michigan's surface waters. The monitoring plan consists of nine program elements: fish contaminants, water chemistry, sediment chemistry, biological integrity, wildlife contaminants, beach monitoring, volunteer monitoring, inland lake quality and eutrophication, and stream flow. The trend monitoring elements of EGLE's water quality monitoring plan are an important part of Michigan's effort to assess the combined effectiveness of all point and NPS load reduction activities.

Strategy

VI-4-A: Coordinate and integrate trend monitoring activities with other NPS monitoring and program priorities to ensure that trend monitoring data are available to assess NPS project and program effectiveness as appropriate.

Short-term Action

VI-4-A-1: The NPS Program will continue to look for opportunities to use EGLE trend monitoring data to assess the effectiveness of the NPS Program. Examples include the fixed station water quality monitoring data used to assess the effectiveness of phosphorus reduction efforts in the Raisin River watershed.

Project Effectiveness monitoring: Documenting the effectiveness of NPS pollution control activities is essential to the long-term success of the NPS Program. While the benefits of a particular BMP may be intuitive to those closest to the watershed, sound effectiveness monitoring strategies must be developed and implemented wherever necessary to provide objective assessments of the merits of NPS pollution control projects.

Developing a procedure for monitoring the effectiveness of NPS pollution control projects in Michigan is confounded by the complexity of aquatic ecosystems and pollution sources to be monitored. Effectiveness monitoring strategies that are appropriate for the largest lakes in the world may not be appropriate for an inland lake. Likewise, Michigan's rivers and streams range from relatively small, high energy event responsive systems to low energy connecting channel rivers, which rank among the largest rivers in the world by volume of discharge. Effectiveness monitoring activities are therefore highly diverse, often with little similarity between seemingly common NPS problems.

The NPS effectiveness monitoring methodologies will range along a continuum of monitoring techniques, from quantitative to qualitative, described in more detail in the 2004 *Nonpoint Source Environmental Monitoring Strategy*. The main factors in deciding whether a given BMP will be monitored qualitatively or quantitatively are:

1. The scale of the impairment's cause(s) (local or widespread).
2. The scale of the impairment's manifestation (local or widespread).
3. The characteristics of the watershed.
4. The size, scale, and type of the NPS pollution control effort.
5. The ability to control sources of variability.
6. The expected lag time in the response of the water body to the BMP.
7. Logistical considerations.

Strategy

VI-4-B: EGLE, grantees, or contractors will evaluate the effectiveness of all CMI and Section 319 pass-through grant projects.

Short-term Action

VI-4-B-1: The NPS monitoring coordinator will work with NPS staff, grantees, and stakeholders to determine the appropriate level of effectiveness monitoring for each pass-through grant project. NPS Program staff will provide descriptions of BMPs or NPS treatments to assist with the effectiveness design studies.

Strategy

VI-4-C: Look for opportunities to develop "showcase" monitoring studies to highlight program success.

Short-term Actions

VI-4-C-1: The NPS Unit monitoring coordinator and district staff will work to identify at least one potential "success story" project for implementation per district per year. "Success" will be broadly defined, to include alternative measures of progress or BMP effectiveness, as well as measureable environmental improvements. Success stories will be submitted to the USEPA by October 1 of each year.

VI-4-C-2: Each year, the NPS monitoring coordinator will develop a list of potential long-term success story projects to be monitored in that year. This list will include pre-BMP and post-BMP monitoring locations. The list will be included in the NPS Program Multi-Year Plan.

VI-4-C-3: The NPS monitoring coordinator will continue to collaborate with NPS district staff and SWAS monitoring staff to implement the National Monitoring Project at the Eagle River. Post-construction monitoring is scheduled to continue intermittently until 2021.

VI-4-C-4: The WRD will continue to implement a ten-year effectiveness monitoring study at Hayworth Creek in the Upper Maple River watershed. The purpose of the study is to assess the effectiveness of the National Water Quality Initiative. Hayworth Creek was selected by the NRCS for targeted funding. The monitoring is scheduled to be completed in 2023.

Strategy

VI-4-D: Continue to explore opportunities to integrate the SFPF and the SQT into monitoring activities and as a way to show project success.

Short-term Actions

VI-4-D-1: NPS staff will continue to provide input into the development of the SQT and help regionalize the tool for statewide applicability.

VI-4-D-2: The NPS Monitoring Coordinator will consider the SFPF when assessing proposals and projects for success story potential. Success may not be reached at higher levels in the pyramid if lower levels are not functioning. Individual parameters within the SQT will be used to show project effectiveness. Any individual parameter that moves from “not functioning” to “functioning at risk”; or “functioning at risk” to “functioning” will be documented as showing success. The SQT will also be used to design monitoring studies to measure long-term progress.

Strategy

VI-4-E: Continue to participate on the the tile line monitoring steering committee.

Short-term Action

VI-4-E-1: Collaborate with MDARD, Michigan State University, Lenawee Conservation District, and other stakeholders to monitor drainage water management control structure effectiveness through September 30, 2022.

CHAPTER 9: PROGRAM OPERATION

Goal VII: Efficient Program Operations

Objective VII-1: Encourage professional development for all NPS staff.

The NPS Program trains staff to ensure that they are capable of providing expert guidance regarding the development and implementation of WMPs; are knowledgeable regarding BMPs and current practices recommended by the program; and are aware of other regulatory requirements and programs used to protect water quality.

Several strategies and short-term actions regarding specific training opportunities are presented in the preceding chapters. However, the following actions are more general and intended to ensure that staff members are well-rounded experts in a variety of topics related to developing and implementing WMPs.

Strategy

VII-1-A: Ensure that NPS Program staff are well trained and capable of providing expert guidance in the watershed approach to addressing NPS water quality issues.

Short-term Actions

VII-1-A-1: Each new NPS Program staff person is assigned an NPS Program staff mentor, preferably in the same district/unit. The mentor is responsible for the following:

- Reviewing the state NPS Program approach with the new staff.
- Including the new staff in representative district NPS activities.
- Accompanying the new staff on representative initial tasks.
- Serving as an expert resource on the state NPS Program and NPS issues.

VII-1-A-2: The NPS Program will maintain a training plan for Program staff.

VII-1-A-3: The NPS Program will annually identify staff training needs and opportunities to gain technical knowledge and expertise in areas of importance to the NPS Program (e.g., land use planning, LID, emerging contaminants, or the use of GIS).

VII-1-A-4: The NPS Program Committee will develop and/or revise procedures and policies so that the day-to-day program activities are carried out consistently across the state. These procedures will be aimed at efficiently achieving program goals.

VII-1-A-5: All NPS staff are encouraged to attend at least one significant training session/workshop/conference each year. Newly hired staff will attend several training opportunities in the first two years of employment.

Objective VII-2: Align staff and resources to meet NPS Program goals; and document and communicate program successes.

The NPS Program has established a series of strategies and short-term actions to ensure effective program implementation.

Strategy

VII-2-A: Look for opportunities to leverage private, federal, state and local sources of funding to develop and implement WMPs to restore impaired waters and protect high quality waters.

Short-term Actions

VII-2-A-1: The NPS Program will continue to leverage matching funds for Section 319 and CMI-NPS grants. These matching funds and matching grants will be reported in the NPS Program's grants database and GRTS.

VII-2-A-2: The NPS Program will target implementation of BMPs in priority watersheds. In addition, the NPS Program will track the number of grant funded practices implemented in GRTS and in the grants database.

Strategy

VII-2-B: Conduct planning and reporting activities necessary to operate an efficient and effective program. This includes documenting the status of program measures of success; planning and reporting requirements necessary to meet statutory requirements and grant obligations; and meeting reporting requirements necessary to demonstrate that Michigan's NPS Program is making "satisfactory progress" toward achieving program goals.

Short-term Actions

VII-2-B-1: The NPS Program Plan will be routinely revised to ensure that priority watersheds as well as program goals, strategies and short-term actions are up-to-date. The Program Plan updates will be completed approximately every two years and a minimum of once every five years.

VII-2-B-2: By October 15 of each year, the NPS Program will develop an annual work plan. This work plan will include all of the relevant short-term actions from the NPS Program Plan. The annual work plan will be used by the WRD for planning purposes and by WRD's NPS Program staff to develop annual performance objectives. In addition, the annual work plan will be provided to the USEPA.

VII-2-B-3: On an ongoing basis, the NPS Program will compile all of the information necessary to comply with regulations regarding the expenditure of state and federal funds. In addition, the NPS Program will continue to participate in financial audits as well as the periodic internal and external NPS Program reviews.

VII-2-B-4: By October 15 of each year, all NPS Program staff will assist with the development of a summary of the status of each of the short-term actions from the annual work plan. This summary will be provided to the WRD management team as well as the USEPA in partial fulfillment of annual reporting requirements.

VII-2-B-5: By October 15 of each year, the NPS Program will provide to the USEPA Region 5 the information necessary to satisfy the Section 319 grant reporting requirements outlined the 2013 *Nonpoint Source Program Grants Guidelines for States and Territories*.

VII-2-B-6: The NPS Unit will develop a summary of measures of success every two years. The summary will be developed in the winter of even years (beginning in 2014) following release of the latest draft of the integrated report. The summary will be posted on the NPS Website and submitted to the USEPA via GRTS.

VII-2-B-7: NPS Program staff, in conjunction with the annual "Partner Awards," will produce a short synopsis of the prior year's program successes which will serve as the focus of a press release and letters to appropriate members of the legislature also announcing the current Partner Award recipients.

NPS Program Measures of Success

The NPS Program will use measures of success to assess and report program effectiveness. The measures of success cover three main categories: environmental, public outreach, and administrative. Attaining measures of success in each of these areas is key to an effective program.

Environmental Measures of Success

The NPS Program has established a series of environmental measures of success related to restoration of impaired waters, protection of high quality waters, protection of wetlands, and control of NPS pollution.

Restoration of Impaired Waters

The NPS Program will work with other local, state, and federal programs to meet Michigan's share of the following three strategic targets established by the USEPA:

Measures of Success

MOS-1: Between October 1, 2017, and September 30, 2022, the NPS Program, in collaboration with other programs, will target restoration of ten water bodies (impaired by pollutants other than mercury or PCB) included on the state's nonattainment.

MOS-2: Between October 1, 2017, and September 30, 2022, the NPS Program will target restoration of 20 specific causes of water body impairment included on the state's nonattainment.

MOS-3: Between October 1, 2017, and September 30, 2022, the NPS Program will improve water quality conditions in five 12-digit HUC watersheds in Michigan.

MOS-4: Between October 1, 2017, and September 30, 2022, the NPS monitoring coordinator and NPS district staff will develop 20 environmental success stories. "Success" will be broadly defined to include alternative measures of progress or BMP effectiveness as well as measurable environmental improvements. This includes using performance standard index values from the SQT and evaluating functional lift using the SFPF.

Protect and Restore Natural Hydrology

The NPS Program will focus on activities to restore and protect the natural hydrology of streams. In addition, the NPS Program will look for opportunities to use stable stream design BMPs as appropriate.

Measure of Success

MOS-5: Between 2018 and 2023, the number of streams in Michigan showing increased flashiness as measured by the R-B Index will not increase. Gauged streams will be divided into three categories: (1) increasing flashiness, (2) decreasing flashiness, and (3) no change. The number of streams with increasing flashiness in 2023 will not increase compared to the number with increasing flashiness in 2012. The number of streams with decreasing flashiness will increase between 2012 and 2023. The 2012 baseline for this measure of success is 39 streams with increasing flashiness and 31 streams with decreasing flashiness.

Protection of High Quality Waters

The NPS Program will focus water quality protection activities on priority watersheds with a goal of preventing the degradation of existing high quality waters by NPS pollution. In watersheds covered by a WMP, the NPS Program will seek to control NPS pollution so that existing designated uses are maintained and protected. Where, for individual pollutants, the quality of

the waters is better than the WQS, that water will be considered high quality and the NPS Program will strive to maintain and protect these high quality waters.

Measures of Success

MOS-6: The NPS Program will target long term protection of 5,000 acres and 140,000 linear feet of river, lake, and wetland in priority watersheds between January 1, 2018, and December 31, 2023. Conservation easements are the primary form of long-term protection.

MOS-7: The NPS Program will target sediment, nitrogen, and phosphorus reductions of 400 tons, 10,000 pounds, and 1,500 pounds, respectively, from long-term protection practices implemented at priority watersheds between January 1, 2018, and December 31, 2023.

MOS-8: No water bodies or reaches in "healthy watersheds", covered by approved nine-element WMPs, and identified as attaining WQS in the 2012 Integrated Report will be moved to the nonattainment list due to NPS causes or pollution. "Healthy watersheds" are defined by the NPS Program as those with high ecological capacity and low stressor scores as determined from the NPS Program's watershed prioritization process (Figure 3.1).

MOS-9: Using the 2012 Integrated Report as the baseline, no water bodies or reaches will be moved to the nonattainment list in watersheds covered by EGLE-approved WMPs administered by "very active" watershed groups. "Very active" watershed groups are defined by NPS district staff and have the following characteristics: regularly advance polices promoting a healthier watershed, continually engage stakeholders through information and education activities, have active monitoring programs, are economically supported by their stakeholders, acknowledged as local experts, and are viewed as critical participants in discussion and decisions related to the watershed.

MOS-10: Between 2018 and 2023, ten ordinances providing additional water quality protections will be established by local governments.

Elimination or Reduction of NPS Pollution

The NPS Program has established the following measures of success related to pollutant load reductions.

Measure of Success

MOS-11: For the years 2018 through 2022, the annual sum of phosphorus, nitrogen, and sediment load reductions from NPS pass-through grant funded projects will be at least 9,000 pounds, 30,000 pounds, and 7,000 tons, respectively.

Protection and Restoration of Wetlands

The NPS Program recognizes the important function of wetlands in filtering pollutants and protecting the natural hydrology of watersheds.

Measures of Success

MOS-12: Between October 1, 2017, and September 30, 2022, the NPS Program will create or restore at least 100 acres of wetlands using pass-through grants.

Public Outreach Measures of Success

The NPS Program has established short-term actions regarding the development of information and education success stories. Success stories document measurable changes in behavior or knowledge and are used to assess the effectiveness of information and education activities and communicate program success.

Measure of Success

MOS-13: The NPS Program will develop ten information and education "success stories" by 2023. These "success stories" will be posted on the NPS Website.

Administrative Measures of Success

The NPS Program has established the following measures of effective program administration.

Measures of Success

MOS-14: The NPS Program will continue to make satisfactory progress in meeting the schedule of short-term actions. Satisfactory progress determinations are made by the USEPA after reviewing annual reporting information.

MOS-15: The NPS Program will review and approve at least 20 new nine-element WMPs between 2018 and 2023.

APPENDIX 1: KEY COMPONENTS OF AN EFFECTIVE STATE NPS MANAGEMENT PROGRAM

In 1997, the USEPA developed *Nine Key Elements of an Effective State NPS Management Program* to guide state efforts to develop approvable NPS Program Plans. In 2013, the USEPA updated their guidance and produced *Key components of an effective state NPS management program.* The following summary identifies how Michigan's NPS Program Plan addresses each of the key components:

Key Component 1: The state program contains explicit short- and long-term goals, objectives, and strategies to protect surface and groundwater, as appropriate.

The NPS Program Plan identifies seven major goals for Michigan's NPS Program. Each goal identifies specific objectives, strategies, and short-term actions to ensure that Michigan meets NPS Program goals. In addition, the document includes a series "measures of success" to help the NPS Program measure progress and communicate success. The goals and objectives are relatively general and identify program priorities and direction. The strategies and short-term actions are more specific commitments and identify responsible parties, products, and completion dates.

Key Component 2: The state strengthens its working partnerships and linkages to appropriate state, interstate, tribal, regional, and local entities (including conservation districts), private sector groups, citizens groups, and federal agencies.

Working in partnership with other stakeholders is a key goal of Michigan's program and specific partnership opportunities are identified throughout the document. Numerous partners and stakeholders are specifically mentioned in short-term actions.

Key Component 3: The state uses a combination of statewide programs and on-the-ground projects to achieve water quality benefits; efforts are well-integrated with other relevant state and federal programs.

The NPS Program Plan emphasizes statewide activities and integration with other relevant state and federal programs in several chapters, including Chapters 4 (Source Control Strategies), 5 (Information and Education), 6 (Funding), 7 (Compliance and Enforcement), and 8 (Monitoring). In addition, Chapter 3 describes Michigan's commitment to the development and implementation of WMPs for priority watersheds. Each water body has distinct water quality characteristics, issues, and stakeholders. Michigan's NPS Program views local WMPs as the most effective way to address water quality issues.

Key Component 4: The state program describes how resources will be allocated between (a) abating known water quality impairments from NPS pollution and (b) protecting threatened and high quality waters from significant threats caused by present and future NPS impacts.

The NPS Program Plan has goals, objectives, strategies, and short-term actions related to protection and restoration of water bodies and watersheds. Also, the update includes a summary of threats and impairments (Chapter 2); describes how monitoring will be used to identify impairments in the future (Chapter 8); and describes how threats and impairments will be addressed at the state and local levels.

Key Component 5: The state program identifies waters and their watersheds impaired by NPS pollution as well as priority unimpaired waters for protection. The state establishes a process to assign priority and to progressively address these identified watersheds by

conducting more detailed watershed assessments, developing watershed-based plans, and by implementing plans.

Michigan's NPS Program relies on the Integrated Report to identify waters and their watersheds impaired by NPS pollution and the NPS Program Plan includes a summary of threats and impairments. In addition, Chapter 8 (Monitoring) describes how new threats and impairments will be identified while Chapter 3 (Watershed Management) describes how watersheds are prioritized and watershed plans are developed and implemented. In addition, Appendix 2 includes a list and a brief description of NPS priority watersheds.

Key Component 6: The state implements all program components required by Section 319(b) of the CWA, and establishes strategic approaches and adaptive management to achieve and maintain WQS as expeditiously as practicable. The state reviews and upgrades program components as appropriate. The state program includes a mix of regulatory, nonregulatory, financial and technical assistance as needed.

The 2019 update to the NPS Program Plan is the latest in a series of updates to the original *1988 Nonpoint Source Pollution Control Management Plan.* The 2019 update addresses the following components required by Section 319(b) of the CWA:

A. The update includes specific references to BMP manuals and provides short-term goals (with target completion dates) to update BMP manuals.

B. The update includes a description of other state, federal, and local programs that will be used to implement BMPs and restore impaired waters.

C. The update includes a schedule for short-term actions intended to reduce or eliminate NPS pollution and restore and protect waters of the state from NPS pollution.

D. EGLE continues to have the authority to use the laws of the state to implement this Program Plan.

E. The update identifies available state and federal sources of funding and includes strategies and short-term actions intended to identify nongovernmental funds that could be used by stakeholders to develop and implement WMPs.

In addition, the NPS Program Plan includes regulatory, nonregulatory, financial, and technical assistance strategies and short-term actions necessary to protect high quality waters and restore waters impaired by NPS pollution or causes.

Key Component 7: The state manages and implements its NPS Program efficiently and effectively, including necessary financial management.

The NPS Program manages a pass-through grant program efficiently and effectively. The process used to help staff identify priority watersheds is identified in Chapter 3 (Watershed Management). Goals, objectives, strategies, and short-term actions related to the management of pass-through grants are described primarily in Chapter 6 (Funding). Strategies and short-term actions associated with the pass-through grant program are included throughout the document.

Key Component 8: The state reviews and evaluates its NPS management program using environmental and functional measures of success, and revises its NPS management program at least every five years.

The NPS Program Plan describes environmental measures of success (Chapter 9) including restoration of impaired waters documented with "success stories" and pollutant load reductions.

Also, the 2019 NPS Program Plan update represents the latest effort to update the original 1988 NPS Pollution Control Management Plan. The update includes a commitment to revise the NPS Program Plan routinely and use the Program Plan to develop annual work plans.

APPENDIX 2: 2019 NPS PRIORITY WATERSHEDS

Lake Superior Basin

- **Eagle River Watershed (HUC 040201030404)**

  The Eagle River watershed historically received waste products from the operation of stamp mills in the mid to late 1800s. The stamp mills separated copper from the rock, and the resulting waste product was termed stamp sand. Stamp sands were disposed of into the river system, and caused physical and chemical degradation. EGLE remediated several areas within this watershed and is conducting effectiveness monitoring as part of the NPS National Monitoring Program.

- **Portage Lake sub-watersheds (HUC 042010303)**

  The Houghton, Michigan area was hit by successive major rainstorms on June 17 and July 11 and 12, 2018. At some locations, these were 1,000- and 100-year rain events, respectively. The flood events were followed by a June 18, 2018, Initial State Declaration of Emergency and a July 25, 2018 Second State Declaration of Emergency. There was widespread damage to homes, roads and other property when abandoned railroad grades washed out and flood waters mobilized debris in other areas. The washouts and flood waters clogged streams, culverts, ditches, and storm sewers with debris. The NPS program will be evaluating impacted Portage Lake tributaries for opportunities to provide technical assistance and develop alternative WMPs to address water quality issues.

- **Eastern Upper Peninsula Tributaries to St. Marys River (HUCs 04020203 and 04070001)**

  45 miles of the St. Marys River was identified as impaired for partial and total body contact recreation due to *E. coli*. An 18-week monitoring project was completed in the summer of 2010 on the St. Marys River and Michigan tributaries to determine if a TMDL was needed for the sampled water bodies. The tributaries included the Charlotte (HUC 0407000101), Waiska (HUC 04020203), Little Munuscong (HUC 0407000101), and Munuscong Rivers (HUC 0407000102), as well as several smaller tributaries in the Sault Ste. Marie, Michigan area. *E. coli* sampling results in the tributaries show widespread exceedances of the total body contact daily maximum WQS and total body contact 30-day geometric mean WQS with a lesser percentage of exceedances of the partial body contact daily maximum WQS. The daily geometric means for all 14 of the St. Marys River transects did not have water quality exceedances during the 16 weeks of sampling.

  The St. Marys River is the connecting channel between Lake Superior and Lake Huron and is an important source of drinking water, recreation, sport fishery, shipping and commerce, and tourism, and is also an area of historical significance for Michigan. Emphasis needs to be placed on implementing BMPs to reduce *E. coli* contributions at high priority sites within the Sault Ste. Marie Area WMP, the Munuscong River WMP, and Waiska River WMP (currently under development). Emphasis is also needed for developing a WMP that identifies and prioritizes sources of *E. coli* in the remaining tributary watersheds to the St. Marys River.

Lake Michigan Basin

- **Bear River, Little Traverse Bay (HUCs 04060105-0101 through -0103)**

  The Bear River is the major tributary to Little Traverse Bay, a high quality oligotrophic embayment of Lake Michigan. This high-gradient river is impacted by urban storm water

runoff as it flows through the steep topography of the city of Petoskey. The river's elevation drop in the last mile is the greatest in Michigan's Lower Peninsula. Sedimentation from stream bank erosion and road crossings are problems in the upstream reaches. The coldwater fishery has been impacted by hydrologic changes from development and dams.

A "Healing the Bear" initiative sponsored by area organizations has been successful at implementing several restoration and protection projects. In 2018, local organizations renewed their focus on the Bear River with the goal of providing a more comprehensive and collaborative approach to enhancing the river. A Bear River Workgroup was established as part of the implementation of the Little Traverse Bay watershed management plan, for which a draft update was completed in January 2019. The workgroup is looking at all aspects of the river, including recreational uses, environmental issues, and community stewardship. A permanent endowment annually funds actions identified in the Little Traverse Bay WMP through a competitive grant application process.

- **Lake Charlevoix (HUCs 04060105-0201 through -0207)**

  Lake Charlevoix is a high quality oligotrophic lake and its largest tributary—the Jordan River—is a state designated Natural River. Lake Charlevoix is Michigan's fourth largest inland lake with the second longest shoreline and the fifth largest watershed, which also includes the Boyne River. The primary lake pollutants of concern are nutrients, with both nutrients and sediment being issues in the tributaries. The Lake Charlevoix Watershed Advisory Committee continues to implement actions identified in the Lake Charlevoix watershed management plan, updated in 2012, and has excellent participation by local governments.

- **Grand Traverse Bay Shoreline Watersheds along West Bay and East Bay (HUCs 04060105-0702 through -0707)**

  The Grand Traverse Bay watershed is one of the premier tourist and outdoor recreation areas in the Midwest, primarily because of the high quality of its water resources. But this popularity has contributed to rapid population growth that threatens the oligotrophic waters of Grand Traverse Bay as well as the numerous small tributaries that flow from the shoreline watersheds bordering the bay. These small tributaries drain much of Traverse City—the largest city in northern lower Michigan—and portions of two of the three fastest growing counties in the state: Grand Traverse and Leelanau.

  The primary pollutants of concern for the bay are nutrients and pathogens. Several swimming beach areas have periodically been identified as not meeting the state total body and partial body contact designated uses because of occasional elevated levels of *E. coli* attributed to storm water flows. Nutrient inputs to the nearshore waters are a concern because of documented increases in the number and areal extent of macrophyte beds over the past two decades. Sand sedimentation and thermal warming is the largest concern within the small tributary watersheds.

  Recognition of the aesthetic, recreational, and economic value of the Grand Traverse Bay watershed's high quality waters, has resulted in the formation of numerous active environmental organizations and inland lake/river associations in the area. These organizations work jointly with local governments and business representatives to implement the Grand Traverse Bay WMP. The Grand Traverse Bay WMP is currently being updated with a focus on the many coastal sub-watersheds, given that the other areas are covered either by a Boardman River sub-watershed WMP completed in 2018 and a WMP currently being developed for the Elk River sub-watershed. The organizations continue to

cooperatively pursue the funding and effective implementation of many environmental protection actions and a current focus is on reducing storm water inputs.

- **Boardman River Downstream from the Confluence of the North Branch and the South Branch (HUCs 04060105-0504 through -0507)**

  This watershed includes the mainstream of the Boardman River—a blue ribbon trout stream and state designated natural river—and extends from the river's mouth at Grand Traverse Bay south and east about 20 miles to Supply Road. The watershed includes most of Traverse City west of Old Mission Peninsula. Deposition of sediment originating from road stream crossings, stream bank erosion, and construction, is the primary pollutant problem in the Boardman River. A Boardman River sub-watershed management plan completed in 2018 is unique in that this "prosperity plan" includes economic planning projected out to the year 2050, in addition to addressing water quality issues.

  The removal of three major dams on the Boardman River mainstream is the largest dam removal project in Michigan's history, and the largest wetlands restoration in the Great Lakes basin. The removal of Brown Bridge Dam, the most upstream dam, was completed in 2013. The two others, Boardman Dam and Sabin Dam, were removed in 2017 and 2018, respectively. Extensive sediment management efforts continue to be implemented to stabilize newly-formed stream banks within the previously impounded areas.

  Kids Creek, which enters the Boardman River in Traverse City, is the most significant tributary within the boundaries of this watershed area. The indigenous aquatic life and wildlife designated use is not supported due to flow regime alterations, anthropogenic substrate alterations, and sedimentation/siltation. Sources of sediment are post-development erosion, urban runoff/storm sewers, and impervious surface/parking lot runoff. Significant work has been conducted implementing storm water BMPs in this watershed over the last several years and a Kids Creek sub-watershed action plan was recently completed to identify specific remaining areas where restoration work is needed.

- **Elk River Chain of Lakes (HUCs 04060105-0403 through -0405; and HUCs 04060105-0303 through -0305)**

  The Elk River contributes roughly 60 percent of the tributary flow to Grand Traverse Bay and is comprised of 14 interconnected lakes and many tributaries, including Torch and Elk lakes, which are the 2 deepest inland lakes in Michigan. A sub-watershed plan for these high quality waters is currently being developed by local partners to provide a more focused approach to this 500-square mile portion of the 1,000-square mile Grand Traverse Bay watershed. The primary pollutant threats are nutrients and sediments from storm water runoff and erosion, along with habitat loss from shoreline development

- **Betsie River from Dair Creek Downstream (HUCs 04060104-0304 through -0307)**

  The Betsie River was the second river in Michigan to be designated a state Natural River and land use zoning covers building setbacks and vegetated buffers. The river is noted for its salmon and steelhead fishing throughout the main stem. Dair Creek is the most downstream of the two important tributaries that contain exceptional trout habitat and provide coldwater to the warmer lower Betsie River. Sediment, nutrients, and thermal inputs are the most significant pollutants of concern. Sources include road stream crossings, stream bank erosion at historical log roll away sites, construction sites, and riparian land uses.

  Crystal Lake is a cold, oligotrophic lake that drains to the Betsie River through the Crystal Lake Outlet, an artificial channel built in 1873. Crystal Lake is Michigan's ninth largest

inland lake with a surface area over 15 square miles, and the state's third deepest inland lake (behind only Torch and Elk Lakes), reaching a maximum depth of 190 feet. Part of the northern portion of the watershed is adjacent to the Sleeping Bear Dunes National Lakeshore. Storm water runoff concerns and periodic elevated levels of *E. coli* exist at the Village of Beulah and are identified as a priority to address in the 2016 Betsie River/Crystal Lake watershed management plan.

- **Portage Lake, Manistee County (HUC 040601040405)**

  Portage Lake is a mesotrophic lake whose watershed drains to Lake Michigan through an outlet channel originally constructed in 1871, which lowered the lake level by several feet. Unlike many watersheds in Michigan's northern Lower Peninsula, there is very little state or federal public land in the watershed. Private land practices associated with forestry, agriculture, recreation, commercial, industrial, and residential uses have had a significant impact on water quality. Nutrient enrichment and habitat loss are the primary environmental concerns. Dissolved oxygen levels in Portage Lake during the summer are typically below 2.0 milligrams per liter at depths greater than 40 feet, and reach near zero at depths of 60 feet.

  An endowment fund, annual fund, and wetland fund provide resources to implement many actions identified in the 2008 Portage Lake watershed management plan. Plan implementation has had remarkable success, partly because of involved local governments and organizations, as well as extensive public information and education programs. One of the most significant successes was when Onekama Township and the village of Onekama formed a joint planning commission and completed a joint master plan that was only the sixth such plan in Michigan. This "Onekama Community Master Plan" included all major elements and priorities of the WMP, enhancing the potential to successfully protect water quality throughout the watershed. A first draft of an updated WMP was completed in January 2019.

- **Little Manistee River (HUCs 04060103-0601 through -0606)**

  The Manistee River system supports one of Michigan's best coldwater fisheries and is particularly renowned for salmon. The Little Manistee River sub-watershed is the sole source of steelhead eggs for Michigan's fish stocking program, which also provides steelhead eggs to other hatchery programs throughout the Midwest. The primary environmental stressors are sediment and nutrients, while maintaining cold water temperatures is a major priority as well. The Little Manistee Watershed Conservation Council is currently coordinating the development of a Little Manistee River watershed management plan with significant participation from local partners.

- **Duck Creek (HUC 040601011008)**

  The Duck Creek watershed is approximately 14,000 acres in size and located entirely within Muskegon County. Duck Creek and its tributaries converge and empty into Duck Lake, a drowned river mouth that drains into Lake Michigan. The majority of the watershed is forested. In 2013, a WMP was developed and approved with a focus on protecting existing high quality waters. EGLE staff are working with local partners to implement goals recommended in the WMP to protect water quality, especially from sedimentation and thermal pollution. Efforts include conservation easements to permanently protect critical riparian lands, outreach and education to local citizens and government officials, and development of master plans and zoning ordinances for adoption by local townships.

- **Mona Lake (HUC 040601011011)**

  Mona Lake is a small, urbanized watershed near Muskegon. This watershed faces a mix of problems including sedimentation, excessive nutrients, pathogens, and invasive plants. The local watershed group has strong leadership, good community support, a working relationship with a wide variety of stakeholders, and a focus on finding innovative solutions. EGLE staff are working with local partners on a phosphorus loading study and water quality model to guide management decisions for the lake.

- **Lower Muskegon River (HUCs 0406010207 through 0406010210)**

  The Lower Muskegon River watershed is known for flashy streamflow and high channel erosion. Major watershed stressors include excessive nutrient loading, sedimentation, thermal pollution and hydrologic flow. The causes include lack of riparian canopy, eroding stream banks, and surface runoff. The Muskegon River WMP recommends structural BMPs and I&E to address these issues. Current efforts by local partners include streambank stabilization, cover crops, installation of vegetative BMPs, and education outreach efforts.

- **Upper Grand River (HUC 04050004)**

  The Upper Grand River watershed is the headwaters to Michigan's longest river and encompasses 700 square miles that include parts of 5 counties. Overall land use in the watershed consists of 44 percent agriculture, 12 percent residential, 3 percent commercial/industrial, 19 percent wetlands, and 22 percent of forested land, rangeland, urban green space, and water.

  The Upper Grand River watershed has a number of designated use impairments. The North Branch of the Grand River and the Portage River fail to meet WQS for biota, dissolved oxygen, and *E. coli*. TMDL allocations were developed for these sections of the Upper Grand River and Albrow Creek in 2003 and 2007, respectively. In 2009, a sanitary sewer was installed in the community of Rives Junction, which should result in improvements to the Albrow Creek watershed.

  Several areas in the watershed contain high quality habitat and natural lands that need to be preserved.

  The Jackson County Conservation District has worked for several years with local communities to implement agricultural BMPs, educate citizens and farmers, restore wetlands, and produce Natural Resource Inventories in several communities to guide growth and protection efforts. They were recently awarded a grant to monitor dissolved oxygen, total suspended solids, and *E. coli* to help track progress made from past implementation activities.

  This watershed is a priority for implementation projects that continue to address both the restoration and protection activities that have been identified in the WMP.

- **Upper Maple River (HUCs 0405000501, 0405000502, 0405000503, and 0405000505)**

  E. coli bacteria levels from human and non-human sources and phosphorus are of concern in the Upper Maple River Watershed. The watershed has a significant amount of agriculture. Sediment, nutrients, and bacteria from cropland and livestock operations are contributing to impairments. Additionally, the Upper Maple River WMP estimates that approximately 770 homes in the watershed have some level of septic system problem. A review of records for 257 homes in the watershed in Shiawassee County found 22 percent of septic systems with SCHD approval dates of 1990 and older. An additional 36 percent of the 257 systems analyzed did not have a record of SCHD assessment. Phosphorus TMDLs

were approved for Pine Creek, and the Upper Maple River and several sub-watersheds are scheduled for an *E.coli* TMDL. Both the Clinton and Shiawassee Conservation Districts are actively working to implement the WMP.

- **Red Cedar River (HUCs 0405000404 and 0405000405)**

  Portions of the Red Cedar River Watershed are impaired for *E. coli* and also for exceeding dissolved oxygen standards impairing the warmwater fishery and other aquatic life use designations. Source tracking has shown the presence of human, bovine, and equine DNA due to improper manure management from animal feeding operations, and failing septic systems. Based on water quality and land use data in the area, sediment and nutrients are additional pollutants of concern in the watershed. Prior to discharging to the Grand River, the Red Cedar River is characterized by heavy sedimentation deposition, urban debris, and high flow fluctuations. An active watershed group exists for the urban areas. Since 2005, The Ingham County Health Department has been sampling for *E. coli* on the Red Cedar River.

- **Upper Looking Glass River (HUC 0405000406)**

  E. coli bacteria levels from agricultural sources and failing septic systems are of concern in the Upper Looking Glass River Watershed. The entire watershed is rural with limited access to central sewer service. 9 of the 11 water bodies in the watershed exceed the PBC WQS and all 11 exceeded the TBC WQS. These water bodies are expected to be listed on the 2018 Integrated Report. A WMP was developed in 2017 and the Shiawassee Conservation District is making this watershed a priority for implementation efforts.

- **Rogue River (HUC 0405000604)**

  The Rogue River has the distinction of being one of Michigan's southernmost trout streams; however, the Rogue River WMP identifies rising summer water temperatures and sedimentation as threats to the watershed. The Lower Grand River WMP identifies the Rogue River as a priority for both restoration and preservation. *E. coli* and PFAS are recently identified concerns in the watershed. Partnerships in the watershed are aimed to protect and restore the Rogue River watershed and address the impacts of development and other pressures due to its location in an urban area by working with local governments and educating citizens. Partners secured an RCPP grant to address agriculture concerns in the watershed and they currently have a 319 grant to restore wetlands. EGLE staff will continue to support partners in their efforts to protect and restore the Rogue River watershed.

- **Indian Mill Creek (HUC 040500060504)**

  The Indian Mill Creek sub-watershed in Kent County is nearly an equal mix of agriculture (39 percent) and urban (43 percent) land use, is impaired by *E. coli* and is not meeting its coldwater fishery designated use. The Friends of Indian Mill Creek watershed group and graduate students from Grand Valley State University have been conducting research in the watershed and partners have secured multiple grants to address concerns in the watershed. LGROW has a grant to provide education on green infrastructure practices and to install rain gardens in the watershed. Additionally, Indian Mill Creek is included in an RCPP grant where partners including LGROW and Kent Conservation District are working to improve agricultural practices. EGLE staff will continue to assist partners in identifying pollutant sources and restoring the watershed.

- **Plaster Creek (HUCs 040500060505 and 040500060506)**

  The Plaster Creek watershed covers about 58 square miles, and its headwaters originate south and east of Grand Rapids, with many of the tributaries coming from agricultural areas around Dutton and Caledonia. The creek flows through commercial and residential areas of the city, as well as through industrial areas and low-income neighborhoods before emptying into the Grand River. Plaster Creek has TMDLs for both *E. coli* and biota. The TMDLs and WMP identify storm water as the underlying cause of impairments in the watershed.

  Partners, including the Plaster Creek Stewards, the city of Grand Rapids, and the West Michigan Environmental Action Council, have undertaken numerous projects to educate both upstream and downstream communities and to implement restoration projects in the watershed. Some of the more notable projects include restoring floodplain connection in Shadyside Park, installing over 74 rain gardens in the Alger Heights neighborhood and employing high school students every summer to install and maintain green infrastructure projects. The city of Grand Rapids currently has a 319 grant to stabilize a ravine and reduce storm water inputs to the watershed. EGLE staff will continue to assist partners in education and restoration efforts.

- **Crockery Creek (HUCs 040500060601-0603)**

  The Crockery Creek Watershed is mainly agricultural and located in Ottawa, Muskegon, and Newaygo Counties. It is impaired by *E. coli* and both EGLE and Ottawa Conservation District staff have had an increasing number of residents express interest in addressing both human and agricultural sources of pollution in the watershed. EGLE conducted additional *E. coli* monitoring in the watershed in 2019 and will support partners in efforts to address impairments.

- **Flat River (HUCs 0405000601 and 0405000602)**

  The Flat River (HUCs 0405000601 and 0405000602) drains a watershed of approximately 564 square miles in Kent, Montcalm, Ionia, and Mecosta Counties. The river is a Michigan Natural River (Part 305, Natural Rivers, of Public Act 451 of 1994). The Flat River supports a very high quality smallmouth bass fishery and biologic community, and several of its tributaries contain naturalized brook trout. However, waters within the Flat River Watershed are impacted or impaired by *E. coli*, nutrients, sediment, warming stream temperatures, and altered hydrology. Both human and livestock sources of *E. coli* have been confirmed and identified, with causes including failing septic systems and agricultural management practices. The Mid-Michigan District Health Department is pursuing implementing ordinances to address *E. coli* contributions from septic systems. Montcalm County passed a millage in 2018 to support the Conservation District in protecting and restoring water quality in the county; and partners including the Kent, Montcalm, and Ionia Conservation Districts as well as the Land Conservancy of West Michigan are pursuing funding to reduce agricultural and human sources of *E. coli* and to protect high quality areas through conservation easements. EGLE staff will continue to support partners in implementing the recently approved WMP.

- **Mill Creek (HUC 040500060503)**

  Mill Creek is a nearly 13,000-acre watershed within the Lower Grand River Watershed with the 2 largest land uses being agriculture (65 percent) and urban (17 percent). The upper two thirds of Mill Creek and Strawberry creek are not optimally supporting their designated use as cold-water habitat due to excessive hydrologic loadings, elevated turbidity, and siltation and sedimentation originating from upland soil erosion from agricultural land and road construction-sites. Mill Creek flows through Dwight Lydell Park. During the early

1900s, Dwight Lydell Park was utilized as an MDNR fish hatchery and Mill Creek was channelized to funnel water to the hatchery ponds by creating 9-foot high concrete walls and lining the bottom and sides of the creek. Kent County Parks has funding through an MDNR Aquatic Habitat Grant and a 319 grant to remove the concrete walls, improve hydrology through floodplain reconnection, and implement vegetative buffers at Dwight Lydell Park. In the last few years district staff have been contacted by landowners in the watershed that are concerned with excessive algae and declining water quality in the creek. EGLE staff will work with Kent County Parks to implement restoration and protection activities at Dwight Lydell Park and will continue efforts to address nutrient inputs and other identified sources of pollution.

- **Rush Creek (HUCs 040500060511 and 040500060509)**

  The Rush Creek Watershed drains an area approximately 59 square miles in Kent and Ottawa Counties in southwest Michigan. The area is experiencing severe development pressure due to its close proximity to the cities of Grand Rapids and Holland. Land use has changed from approximately 16 percent developed in 1992 to 51 percent developed in 2011, and development has continued since 2011. The area has an agricultural history, and agricultural land uses make up approximately 35 percent of the watershed as of 2011, though, today, most agricultural land uses are in the East Branch Rush Creek sub-watershed. *E. coli* and altered hydrology are identified as the highest priority pollutants in the recently approved WMP. Partners such as Jamestown Township and the Ottawa County Water Resources Commission are actively seeking funding to lower *E. coli* levels to meet WQS and decrease the effects of altered hydrology. EGLE staff will continue to support partners in implementing the recently approved WMP.

- **Buck Creek (HUC 40500060510)**

  The Buck Creek Watershed is a tributary of the Grand River located in Kent and Allegan counties. Buck Creek has an *E. coli* TMDL and recent monitoring conducted by Trout Unlimited with funding through a CMI Water Quality Monitoring grant, indicates nutrients, sediment, and altered hydrology are also issues in the watershed. The Friends of Buck Creek watershed group have been working to educate residents about Buck Creek and along with partners such as the cities of Grandville, Kentwood, and Wyoming conduct a creek cleanup annually. Trout Unlimited has 205j funding to update the WMP. EGLE staff will work with partners to update the WMP and implement restoration activities.

- **Thornapple River (HUC 04050007)**

  The Thornapple River watershed, located in the southwestern portion of Michigan, includes 31 sub-watersheds and is the largest subbasin of the lower Grand River watershed. Though the prevalent land use in the watershed is agricultural, 17 of its streams are designated trout streams, including the main stem of the Coldwater River. Streams in much of the upper and middle portions of the watershed were historically channelized for agricultural purposes and are currently maintained as drains. Channelization affects the ability of several of the watershed's designated trout streams to support a coldwater fishery. There are been two significant manure discharges from farms in the Coldwater watershed in the first few months of 2019. EGLE staff will continue efforts to ensure CAFO permit compliance and enforcement as appropriate.

  Many collaborative projects are currently taking place in the watershed with a variety of funding sources to address water quality concerns. Projects include riparian protection ordinances, volunteer monitoring, ongoing dam removals, research projects, conservation easements, and fisheries habitat restoration and protection. The Barry Conservation District

has a GLRI grant to address both agricultural and human sources of *E. coli* in upper sub-watersheds. Trout Unlimited currently has a 205j grant to update the Coldwater watershed management plan. EGLE staff are providing assistance with tillage surveys in three sub-watersheds and will continue to assist partners in efforts to protect and restore the Thornapple River watershed.

- **Lake Macatawa (HUC 04050002)**

  Lake Macatawa, in southern Ottawa County and northern Allegan County, is a 1,780-acre drowned river mouth lake that discharges to Lake Michigan. The prevalent land use in the watershed is agricultural. Turbidity, color, settleable solids, suspended solids, and deposits are problems in the lake.

  Many collaborative projects are currently taking place in the watershed with a variety of funding sources to address water quality concerns. These projects are directed through the Macatawa Area Coordinating Council and Project Clarity. The Macatawa Area Coordinating Council is an area-wide association, comprised of government units located adjacent to Lake Macatawa, which facilitates consensus building on public policy decisions that impact the greater Holland/Zeeland communities. Project Clarity is a consortium of public and private organizations working to remediate water quality issues in Lake Macatawa and the Macatawa Watershed. EGLE staff are working with local partners on stream bank stabilization, implementation of agricultural BMPs and I&E efforts.

- **Kalamazoo River, downstream of Morrow Pond to Lake Allegan (HUCs 04050003-05 through--09)**

  The middle portion of the Kalamazoo River is the most critical area for the transport of nutrients to Lake Allegan; an instream impoundment. Lake Allegan has a TMDL for phosphorus that is currently in its implementation stage. Further BMPs are needed in both urban and agricultural areas to reduce phosphorus loadings. In addition, many areas of the main stem of the Kalamazoo River remain undeveloped due to past industrial activities, which resulted in air and water pollution. As the Kalamazoo River becomes increasingly popular for recreation, it is critical that riparian areas be preserved for water quality protection. In developed and developing areas of the river corridor, storm water management, appropriate setbacks, and riparian buffer strips should be encouraged through ordinances and public education.

- **Rabbit River (HUC 0405000308)**

  The Rabbit River is a tributary of the Kalamazoo River located primarily in Allegan County with a watershed that encompasses 187,200 acres. Land use in the watershed is primarily agricultural, but forested and urban areas are also represented. The Rabbit River WMP states that water quality threats and impairments are caused by sedimentation, nutrient inputs, and high-flow occurrences. The sources of sediment include stream banks, cropland, construction-sites, and road crossings/road ditches. Nutrients enter the stream from agricultural production and residential area runoff. Damaging high flows result from uncontrolled storm water runoff due to development and past drainage practices. Unrestricted livestock access has been identified as a significant issue throughout the watershed. Monitoring for *E. coli* was conducted by EGLE staff in 2018, and showed that exceedances of the water quality standard are present in both wet and dry weather conditions. Septic systems and illicit discharges are potential sources of dry weather exceedances. Livestock access to riparian areas and manure applications are likely sources of wet weather exceedances. Wetland restoration, restricting livestock access,

implementation of buffer strips, and installation of two-stage channels are needed BMPs in this watershed.

- **Gun River (HUC 0405000307)**

  The Gun River watershed encompasses an area of 73,272 acres in Allegan and Barry Counties. The Gun River flows from Gun Lake through agricultural land into the urbanizing area of Otsego Township, Allegan County, where it joins the Kalamazoo River. The watershed has been significantly altered from its pre-settlement conditions, primarily due to agricultural development. Many of the forests have been cleared and the wetlands drained. Sedimentation and excessive nutrient inputs have resulted in areas of the watershed exhibiting degraded aquatic habitat, decline of biodiversity, and reduced fish populations. Agricultural BMPs need to be implemented in the farmed areas.

  The Fenner Creek sub-watershed (HUC 04050030702) was identified as one of the top ten scoring sub-watersheds for preservation, as determined by the Kalamazoo River Conservation Plan, which was completed in 2014. Fenner Creek was identified as a priority sub-watershed for land preservation, in a process that heavily weighted water quality metrics. EGLE staff believe that this sub-watershed should be targeted for conservation easements, and storm water and riparian ordinances.

- **Spring Brook (HUC 0405000306)**

  Spring Brook is a coldwater tributary to the Kalamazoo River immediately downstream of the city of Kalamazoo. A 1991 EGLE biological survey conducted on Spring Brook indicated that this stream had the highest habitat quality for fish and other aquatic life of any coldwater stream of similar size that was sampled in southwestern Michigan. Brown trout of varying sizes were observed as well as high numbers and diversity of aquatic insects. A more recent biosurvey, conducted in 2004, found that approximately one mile of the riparian zone had been completely removed and replaced by subdivisions and lawns near Riverview Drive. In addition, numerous small dams and obstructions were historically installed by landowners in this stretch. A survey conducted farther upstream, at DE Avenue, found a largely unimpacted riparian zone and an excellent macroinvertebrate community. Pollutants associated with development including sediment, phosphorus, and thermal inputs are the primary threats to this watershed. Preservation and restoration of riparian buffers are needed in this watershed.

- **Augusta Creek and Kalamazoo River Floodplain (HUCs 40500030505, 040500030506 and 40500030508)**

  The Augusta Creek sub-watersheds within the Kalamazoo River watershed encompass a number of high quality streams and lakes. While phosphorus levels in the watershed remain at acceptable levels, development pressure and CAFOs are concerns. Preservation of the riparian land is critical to provide an adequate buffer between agricultural operations and new development and water bodies. In addition, storm water discharges need to be managed through appropriate ordinances and control measures to prevent flashy flows and stream bank scouring.

- **Battle Creek (HUC 040500030503)**

  The 10-digit HUC for the Battle Creek River encompasses three of the top ten scoring sub-watersheds for preservation, as determined by the Kalamazoo River Conservation Plan, which was completed in 2014. Ackley Creek, Wanadoga Creek, and Clear Lake-Battle Creek were all identified as priority sub-watersheds for land preservation, in a process that heavily weighted water quality metrics. This determination is consistent with EGLE's

10-Digit HUC Prioritization Summary Score. This sub-watershed is ranked fourth out of eight for the Kalamazoo River Watershed based on EGLE's process, and scores high for preservation, yet also has a fairly high score for stressors. EGLE staff believe that this sub-watershed should be targeted for conservation easements, and storm water and riparian ordinances.

- **Black River (HUC 0405000202)**

  Sediment and nutrients are the largest pollutants of concern in the Black River watershed (Allegan and Van Buren Counties). The Two Rivers Coalition, a recently incorporated nonprofit organization, is a strong, proactive watershed group representing the Black River watershed (and the adjacent Paw Paw River watershed). The Two Rivers Coalition is a partner on a Section 319 NPS grant recently awarded to the Van Buren Conservation District, which will focus on wetland protection in the watershed.

- **Paw Paw River (HUCs 04050001-24 and -25)**

  The St. Joseph WMP identified the Paw Paw River sub-watershed as one of the highest priority (i.e., the top three critical areas) for preservation efforts based on: (1) a scoring system for percentage of wetland and forest cover as well as trout lakes and streams in the sub-watershed; (2) the top three preservation sub-watersheds form a contiguous land mass surrounded on all sides by urban and developing areas; (3) potential for regional cooperation; and (4) existence of a sub-watershed WMP.

  The Paw Paw River has several designated trout streams. In particular, the east branch of the Paw Paw River is identified as a top quality, coldwater fishery. The mouth area of the watershed is impacted by urbanization, but there is a need for protection in the form of land use planning in the middle and upper portions of the watershed.

  The Two Rivers Coalition, a recently incorporated nonprofit organization, is a strong proactive watershed group representing the Paw Paw River watershed (and the adjacent Black River watershed). Sediment and nutrients are the largest pollutants of concern in the Paw Paw River watershed. The Two Rivers Coalition is a partner on a Section 319 NPS grant recently awarded to the Van Buren Conservation District, which will focus on wetland protection and restoration in the watershed.

- **Prairie River (HUC 0405000107)**

  Channelization and agricultural land drainage have been identified as a concern in the Prairie River sub-watershed. A 2002 EGLE biological survey indicated that macroinvertebrate communities rated "acceptable" (although nearly excellent) to "excellent." Stream habitat was mostly "fair" with one station "good." A 2007 EGLE biological survey report indicated support of the coldwater fisheries designated use at the Bowers Road station. Another site farther downstream supported an abundance of warmwater fish taxa, although this segment is designated as coldwater. A watershed management planning grant has recently been initiated through the Branch County Conservation District.

- **Fawn River (HUC 0405000108)**

  Based on results of Soil and Water Assessment Tool modeling, the Fawn River watershed was identified in the St. Joseph River WMP as one of the top three critical sub-watersheds for mitigation of agricultural impacts. Sediments and nutrients are the primary pollutants of concern. Recent EGLE biological surveys indicated largely "excellent" macroinvertebrate populations, minimal disturbance of stream habitat despite abundance of agricultural land use, diverse stream habitat, wide-wooded floodplain, and "good" water quality. The

LaGrange Soil and Water Conservation District in Indiana is pursuing a WMP grant for the Fawn River watershed.

- **Little Portage Creek (HUC 0405000109)**

  Biosurvey sampling conducted at a single station in 2005 resulted in a poor fish metric score, and an acceptable macroinvertebrate metric score. The total and partial body contact recreation designated uses are impaired, with an *E. coli* TMDL completed in 2012. Additionally the warmwater fishery designated use is impaired due to anthropogenic substrate alterations. There is local interest in developing a WMP.

- **Portage River (HUC 0405000105)**

  Biosurvey sampling conducted at a single station in 2005 resulted in an acceptable fish metric score, and an excellent macroinvertebrate metric score. The total and partial body contact recreation designated uses are impaired in Dorrance Creek, with an *E. coli* TMDL scheduled for 2018. The current WMP was developed by an MS4 group; however, it does not meet CMI or Section 319 criteria. There is local interest in upgrading the WMP to meet the aforementioned criteria.

- **Galien River (HUC 0404000102)**

  The Galien River is a priority due to the existing problems with pathogens with source areas covering a majority of the watershed. Other major pollutants threatening and impairing the watershed are sediment and nutrients. The Conservation Fund leads a local watershed group.

Lake Huron Basin

- **Rifle River (HUC 04080101)**

  The Rifle River is a state designated Natural River and is heavily used for recreation including fishing and canoeing. The Rifle River is threatened by sediment inputs from uncontrolled livestock access, gully erosion-sites, stream bank erosion, and erosion from road stream crossings. Urban storm water discharges from the city of West Branch also pose a potential threat to this coldwater river. A watershed implementation grant has been completed for the Rifle River and the Rifle River Restoration Committee is currently active in implementation practices. This committee is well supported by the two resource conservation and development councils that cover the area.

- **Kawkawlin River (HUC 04080102)**

  The Kawkawlin River has been identified as a critical watershed as part of the SBCI Program. The Kawkawlin River watershed drains to the southwestern portion of Saginaw Bay and provides important recreational opportunities. This area has, and continues to experience, problems with pathogens. Historically, the Kawkawlin River has also experienced impacts from elevated phosphorus levels (nuisance algae and duckweed). The local community is working on a watershed planning grant.

- **Pigeon River (HUC 0408010302)**

  The Pigeon River watershed is located in the “thumb” area of Michigan’s Lower Peninsula in Huron County and very small portions of Tuscola and Sanilac Counties. Spanning approximately 145 square miles (92,799 acres), the watershed is part of the Eastern Coastal Basin in the larger Saginaw Bay Drainage Basin, and includes coastal shoreline along Saginaw Bay in Lake Huron. The Pigeon River originates as a series of agricultural drains and flows approximately 40 miles north to its confluence with Saginaw Bay. Over 190 miles

of tributary channels have been established as county drains throughout the watershed. Approximately eight miles are currently established as inter-county drains. Land use in the watershed consists of 82 percent agricultural, 5 percent urban, 10 percent forestland, and 3 percent wetland. Five main categories of causes of NPS pollution were identified in the Pigeon River WMP including stream bank erosion, rill and gully erosion, tile outlets, road-stream crossing erosion, and livestock access. Failing septic systems are also a suspected source of pollution in the watershed. Reduction of phosphorus loadings from this watershed to the Saginaw Bay is a key goal identified in the WMP.

- **Pinnebog River (HUC 0408010303)**

  The Pinnebog River has been identified as a critical watershed as part of the SBCI Program. The Pinnebog River has been noted as having elevated phosphorus levels, and organic deposits have been a problem near the river mouth for the last several years. The local community has completed a WMP for this water body and is working to implement the WMP.

- **Chippewa River (HUCs 0408020201, 0408020202, 040802020501, and 040802020508)**

  There are several sub-watersheds that are not supporting the total and partial body contact recreation designated uses because of elevated *E. coli* levels. Lack of or failing on-site wastewater treatment systems, as well as agricultural practices are likely both causes of *E. coli* impairments. Enforcement actions have been taken against a local community to address their untreated/partial treated sewage discharge. Staff will continue to look at other communities that could also be discharging raw or partially treated sewage. Isabella County recently passed a Time of Transfer Program which will help in identifying and addressing failing on-site wastewater treatment systems. There is an active watershed group that has been working to develop a WMP. Recently the Saginaw Chippewa Indian Tribe worked with the USACE to develop a proposal for funding for a WMP. The development of a WMP will help identify high priority agricultural areas and secure funding to implement agricultural BMPs.

- **Cedar River (HUC 0408020102)**

  The Cedar River, a tributary to the Tittabawassee River, has stretches that are declared blue ribbon trout streams. The watershed is threatened by sediment inputs from uncontrolled livestock access, gully erosion sites, stream bank erosion, and erosion from road-stream crossings. The watershed should be a focus for protection as it remains relatively undeveloped. The local community currently has two watershed grants to implement BMPs and permanent conservation easements. Restoration of existing NPS pollution sites is important to maintain the high quality nature of this watershed.

- **Upper Pine River (HUC 0408020203)**

  The Upper Pine River Watershed consists of twelve sub-watersheds upstream of the city of St. Louis and including the city of Alma. The watershed drains 308.5 square miles of land, 77 percent of which is agriculture, with only 12 percent of the land forested, 6 percent open fields, 3 percent urban, and 2 percent wetlands. Major water quality concerns include high levels of *E. coli* restricting recreational activities, long-term safety of the drinking water supply, limited fish health, algae blooms and overgrowth of vegetation, sedimentation, agricultural runoff from manure application and tile drainage, and degraded septic systems. To date, local involvement has been extensive and includes concerned citizens, municipalities, and officials. A WMP is currently being developed for the Upper Pine River Watershed.

- **Shiawassee River (HUC 04080203)**

  The Shiawassee River is a good quality warmwater stream that flows in a northerly direction from its genesis in Livingston and Oakland Counties and discharges into the Saginaw River and eventually into the Saginaw Bay of Lake Huron. The Shiawassee River watershed consists of mixed agricultural and urban land uses and covers 1,266 square miles or 742,400 acres. NPS Program efforts to date have focused on the Mid-Shiawassee River watershed, which makes up the central portion of the watershed and is 227 square miles or 138,178 total acres in size.

  Portions of the Holly Drain (HUC 040802030203), a sub-watershed to the Mid-Shiawassee River, are covered by an *E. coli* TMDL. In addition, designated use impairments due to anthropogenic substrate alterations and flow regime alterations have been documented in the Webb Creek sub-watershed (HUC 040802030201). These tributaries flow primarily through rural areas where NPS such as failing septic systems, agricultural runoff, animal access sites, and stream bank erosion have been identified. An update to the Mid-Shiawassee River WMP was completed and approved under CMI and Section 319 criteria in 2011. It is a priority for the NPS Program to continue to work with the local watershed group in addressing NPS pollution in the nonattainment areas of the river.

- **Flint River (HUC 04080204)**

  The Flint River watershed drains approximately 1,332 square miles and has 18 sub-watersheds. The watershed has a population of over 600,000 people, 250,000 of whom depend on the Flint River as an emergency backup supply for drinking water. Major tributaries include the South and North Branch Flint Rivers, and Kearsley, Thread, Swartz, and Misteguay Creeks. Moderately stable flow is found in the upper South Branch Flint River and in the headwater reaches of some tributaries. Land use in the Flint River watershed is dominated by agriculture (49 percent) followed by forested (16 percent), non-forested (15 percent), urban development (15 percent), and wetland (3 percent). The loss of wetlands from channelization and tiling has decreased flow stability, increased erosion and sedimentation, and altered stream temperature regimes.

  The North Branch of the Flint River (HUC 0408020404) and the South Branch of the Flint River (HUC 0408020401) are prioritized for NPS control activities. These watersheds include Kearsley Creek, Gilkey Creek, and the South Branch of the Flint River, which have approved WMPs and active stakeholder involvement. NPS pollution from septic systems, stream bank erosion, agricultural runoff, fertilizers, pesticides, urban storm water runoff, and increased development are of concern within these watersheds. The South Branch of the Flint River watershed is a high priority for protection practices due to its hydrologic stability, in-stream habitat, and biologic diversity.

  The North Branch of the Flint River includes the Holloway Reservoir and Mott Lake, which provide recreational opportunities in the region with numerous local parks, beaches, and access points located on these water bodies. NPS pollution has been identified as contributing to designated use impairments in the Holloway Reservoir and Mott Lake.

- **Cass River (HUC 04080205)**

  The Cass River watershed encompasses an area of 908 square miles (approximately 578,812 acres), contains 1,352 total river miles, and hundreds of miles of county drain. Of the total river miles, only 352 linear miles are classified as perennial. The Cass River flows to the Saginaw River and eventually to Saginaw Bay. Located in Michigan's Lower Peninsula's thumb region, the watershed includes portions of Genesee, Huron, Lapeer, Saginaw, Sanilac, and Tuscola Counties. The watershed has a number of

designated use impairments and is currently covered by TMDLs for *E. coli* and dissolved oxygen. While relatively clean water flows in the Cass River system, sediment and nutrient enrichment continue to threaten water quality. The major sources of sediments and nutrients are eroding stream banks and road crossings as well as agriculture. Restoration of the impaired stream reaches and protection of the natural forested riverine corridor are key priorities for this watershed.

Lake Erie Basin

- **St. Clair River/Lake St. Clair (HUCs 04090001 and 04090002)**

  This high priority area includes the Pine, Black, and Belle Rivers, as well as direct drainage watersheds to the St. Clair River and Lake St. Clair in St. Clair and Macomb Counties. Lake St. Clair and the St. Clair River provide drinking water to more than five million residents in Michigan and Ontario, and are among the most heavily used recreational areas in the Great Lakes for fishing, boating, and swimming. It is estimated that nearly 50 percent of all sport fish caught in the Great Lakes are caught in Lake St. Clair, and that recreational boating in the lake contributes over $200 million a year to the economy of southeast Michigan. Abundant shoreline along the river and lake also provides many recreational opportunities for local residents and tourists.

  The St. Clair River has been identified as a Great Lakes AOC by the United States and Canadian federal governments. Lake St. Clair was identified as a Biodiversity Investment Area at the 2000 State of the Lakes Ecosystem Conference as well as a priority “eco-reach” that provides critical habitat for numerous plant and animal species, especially in the region’s coastal wetlands. In the Belle River watershed, recent surveys have confirmed very high mussel species diversity that includes endangered mussel species.

  Intermittent beach closures due to elevated bacteria levels, failing or inadequate septic systems, sites of unrestricted cattle access, and illicit discharges are problems in the area. Despite the significant progress made over the past five years to correct problems, issues remain due to soil type and historical development in the area.

  The Belle River WMP was completed in 2015 and a WMP was developed for the Black River in October 2010.

- **Clinton River North Branch (HUC 0408000303)**

  The Clinton River North Branch sub-watershed is located primarily in Macomb County, encompassing a large portion of the central and northern areas of the county and extending into Oakland, Lapeer, and St. Clair Counties. These headwater streams are high quality, coldwater designated trout streams that provide recreational activities for the region.

  Historically, the Clinton River North Branch sub-watershed experienced a significant loss of wetlands as agriculture and other land uses expanded in the region. Today, the land use in the Clinton River North Branch remains predominately agricultural. However, due to the area’s close proximity to metro Detroit, development pressure continues to threaten the remaining wetlands, natural areas, and agricultural land of the sub-watershed. This development pressure has created an increasing need to take preventive/proactive actions to help preserve the water quality of the Clinton River North Branch.

  The Clinton River North Branch has an active watershed advisory group, which was instrumental in the development of a WMP for the Clinton River North Branch. The Clinton River North Branch WMP was CMI and Section 319 approved in 2011 and since its approval, the watershed advisory group has been seeking opportunities to implement actions from the WMP.

- **Stony (HUC 0409000301) and Paint Creeks (HUC 040900030104)**

  Stony and Paint Creeks are hydrologically separate sub-watersheds; however, they are considered as one by the Stony/Paint sub-watershed group due to their close proximity and shared communities within their drainage areas. Both creeks are high quality, coldwater tributaries of the Clinton River. Stony Creek continues to retain many high quality characteristics, but it is threatened by increasing development, particularly in the southern end of the sub-watershed. Stony Creek is home to a wealth of unique natural areas that are protected in both the public and private domains. Paint Creek is managed as a trout stream from Lake Orion to its confluence with the Clinton River. Brown trout reproduce in Paint Creek, but they are supplemented with an annual stocking by the MDNR. Much of the stream is bordered by public land and recreational trails, making it valued by the public in southeast Michigan due to its numerous recreational opportunities and high potential for sport fishing.

  As development in the watershed continues, the potential for negative environmental effects on Stony and Paint Creeks increases. Problems of concern include water quality impacts from erosion, sedimentation, and increased inputs of storm water pollutants, as well as water quantity impacts from more impervious surfaces and the loss of wetlands, woodlands, and riparian vegetation.

  Fourteen communities, two counties, and two school districts were involved in the development of the CMI and Section 319 approved Stony Creek/Paint Creek WMP and they continue to meet at least bi-annually.

- **Pebble Creek (HUC 040900040404)**

  Pebble Creek, located in south central Oakland County (primarily Farmington Hills, Southfield, and West Bloomfield Township), is a headwater tributary to the Main 1-2 Branch of the Rouge River. Dominated by low/medium density residential land use, urbanization and urban storm water runoff are significant sources to the creek's impaired designated uses (Partial/Total Body Contact Recreation, Warm Water Fishery, Indigenous Aquatic Life and Wildlife, and Fish Consumption) and Rouge-wide TMDL's [*E. coli* (2007); Sediment (2007); and, scheduled, PCB (2014) and DO (2022)]. A WMP was completed in 2019.

- **Rouge River Main 3-4 in the City of Detroit – Upper Rouge Tributary Area (HUC 040900040404)**

  The Main Branch of the Rouge River enters the city of Detroit at its northwest corner, then flowing south along its western border and through two environmentally significant park lands – Eliza Howell Park (where the Upper Branch converges) and Rouge Park. This reach of the Rouge is an important resource to the city, which although defined by the Detroit River on its south-eastern front, is otherwise virtually devoid of inland surface water features being primarily served by combined sewers. As is the case in many areas of this highly urbanized watershed, this reach has several impaired designated uses (Partial/Total Body Contact Recreation, Warm Water Fishery, Indigenous Aquatic Life and Wildlife, and Fish Consumption) and Rouge-wide TMDL's [*E. coli* (2007); Sediment (2007); and, scheduled, PCB (2014) and DO (2022)]. This reach is plagued, most notably, by uncontrolled CSOs directly from Detroit and indirectly (via tributaries) from neighboring communities (Dearborn Heights and Redford Township). Multiple control and treatment facilities and structures have made substantial progress toward reducing and/or eliminating CSOs in this area, yet significant investments are still needed to address remaining

uncontrolled CSOs. Due to financial reasons, the city had to abandon a $1 billion Upper Rouge Tunnel project (now used interchangeably with Upper Rouge Tributary; URT) that was expected to largely address the CSO issues for Detroit (and the two neighbors). EGLE and the USEPA worked with the Detroit Water and Sewerage Department to develop a Green Infrastructure (GI) program ($50 million over 20 years), integrated with the city's 2012 NPDES permit, intended to reduce flows into the system and potentially limit additional gray infrastructure needed to fully address CSOs in the URT area. The Great Lakes Water Authority's GI Program along with urban revitalization efforts, such as blight removal and vacant land repurposing (e.g., highlighted by the 2012 Detroit Strategic Framework, Detroit Future City), have drawn broad interest in GI planning and investment from public, private, nonprofit and philanthropic groups at the local, regional, state, and national levels.

- **Ecorse Creek (HUC 040900040501)**

  Ecorse Creek is a highly urbanized watershed located in Wayne County. There are three primary water courses within the watershed that drain into the Ecorse Creek, which then drains to the Detroit River. These are the North Branch, the LeBlanc Drain, and the Sexton-Kilfoil Drain. All three major water courses within the watershed have extensive hydraulic and pollution problems.

  The Ecorse Creek watershed, in its entirety, is identified on Michigan's Section 303(d) list as failing to meet Michigan WQS for pathogens and for the protection of warmwater aquatic life. A TMDL, water quality targets, and quantifiable pollutant load reductions have been developed to protect aquatic biota within the Ecorse Creek watershed. In 2008, a TMDL for *E. coli* was developed for the Ecorse Creek watershed.

  The Ecorse Creek watershed has a CMI- and 319-approved WMP. Communities in the Ecorse Creek watershed are part of a larger combined watershed group called the Alliance of the Downriver Watersheds. This is comprised of the Ecorse Creek watershed, the combined downriver watershed, and the Lower Huron River watershed. The Alliance of the Downriver Watersheds is active and continues to meet regularly.

- **Upper Huron River/Kent Lake (HUC 040900050106)**

  The Kent Lake sub-watershed of the Huron River is located in southwestern Oakland County and extends into Brighton and Green Oak Townships in Livingston County. The drainage area is 556 square miles extending from the headwaters of the Huron River downstream to the Kent Lake impoundment in the Kensington Metropark. The sub-watershed contains nearly 700 individual lakes comprising approximately 9,000 acres, Pettibone and Norton Creeks, and innumerable wetlands.

  Land use in the Kent Lake sub-watershed ranges from heavily commercial and residential areas in the east and south to small rural farms and housing in the north and west. There are two Metroparks and four state recreation areas in the sub-watershed, along with numerous county, city, and village parks totaling roughly 22,000 acres of publicly owned land. So exceptional is the ecological value of this area that the Nature Conservancy recently deemed portions of the sub-watershed as "globally significant."

  Water quality concerns in the watershed range from nutrient and bacterial loading issues that result in many beach closings in the area, to issues of water clarity and toxicity. Additional water quality concerns include turbidity, conductivity, pesticides, and pollutants such as PCBs and mercury. 14 communities, 1 county, and 1 school district were involved in the development of the Kent Lake/Upper Huron WMP and they continue to meet periodically.

The Huron River Watershed Council received a SAW grant in 2014 to develop a nine element WMP for Norton Creek. An approved TMDL for dissolved oxygen and sedimentation/siltation was written for Norton Creek in 2009.

- **Middle Huron River Subbasins (HUCs 04090005-02 through -04)**

  The Huron River watershed is a Michigan natural treasure. More than 525,000 residents use the river for recreation, drinking water, and power generation. The river supports one of Michigan's finest smallmouth bass fisheries, and is the only designated Scenic River in southeastern Michigan. The watershed contains two-thirds of the area's public recreation lands, and is home to numerous threatened and endangered plant and animal species and habitat types. The Nature Conservancy has recognized the ecological value of portions of the watershed and counts it among the Conservancy's aquatic conservation priorities in Michigan.

  The Middle Huron watershed, located in the vicinity of Ann Arbor, has water quality issues related to phosphorus, sediment, altered hydrology, and pathogens.

  There is an active group of communities and institutions that have been implementing activities to reduce phosphorus and other pollutants since 1995. The highest ranking sub-watersheds for phosphorus loading are Mill Creek, Mallets Creek, and Fleming Creek. Of these, Fleming Creek is in need of a WMP to guide restoration activity. Sediment is a concern in several Middle Huron sub-watersheds including Honey Creek, Millers Creek, Mallets Creek, and Swift Run. Many of these sub-watersheds have also been highly modified by hydrologic alterations and need restoration activities aimed at detention, wetland restoration, LID, or other means of GI that retains water on-site longer.

- **Portage Creek Subbasin (HUC 0409000503)**

  The Portage Creek watershed covers 89 square miles of the 908-square mile Huron River watershed. It lies upstream of the Middle Huron section. It encompasses parts of six townships, two villages, and four counties. Nearly 16,000 acres of lakes and wetlands are located in the watershed. More than 11,300 acres are publicly-owned state land. The protected natural areas contain some of the most diverse and rich native ecosystems remaining in the Portage Creek watershed and southeastern Michigan. It is also one of the most unstable streams in the Huron River watershed and is threatened by altered hydrology as well as lack of development standards and protection ordinances.

  Areas of high habitat quality and species diversity persist in the watershed due to the extent of state-owned lands, undeveloped private lands, and land protected through conservation easements. The connectedness and expansiveness of the remaining natural areas and native habitats directly impact the water quality in the watershed. As the Portage Creek watershed communities develop, there is potential for negative environmental impacts to increase, including water quality impacts from erosion, sedimentation, and increased inputs of storm water pollutants. Hydrology is impacted as wetlands, woodlands, floodplains, and other natural features that regulate water quantity are altered or replaced with impervious surfaces.

  The remaining natural areas in the Huron River watershed were mapped and prioritized in 2002, and updated in 2007, through the Bioreserve Project of the Huron River Watershed Council. 102 sites (23,908 acres) in the Portage Creek watershed were identified as priority natural areas.

  The priority goals and objectives in the Portage Creek watershed include maintaining and increasing the natural buffers, increasing the amount of protected land through ordinances

and conservation easements, restoring converted wetlands, increasing the use of development standards, and promoting low-impact development concepts.

- **Raisin River – Headwaters (HUC 0410000201)**

  The headwater portions of the Raisin River, specifically Iron Creek, Goose Creek, Evans Creek, and the Upper Raisin River, have been identified by the Nature Conservancy as having significant regional ecological importance due to the remaining diverse mussel beds. This region has the most historically intact assemblage of mussels and other aquatic species of any river in southern Michigan. Currently, water quality is fairly good in these upper reaches. The Raisin River WMP lists these as high priority areas for protection measures including land use controls, buffers, easements, and ordinances.